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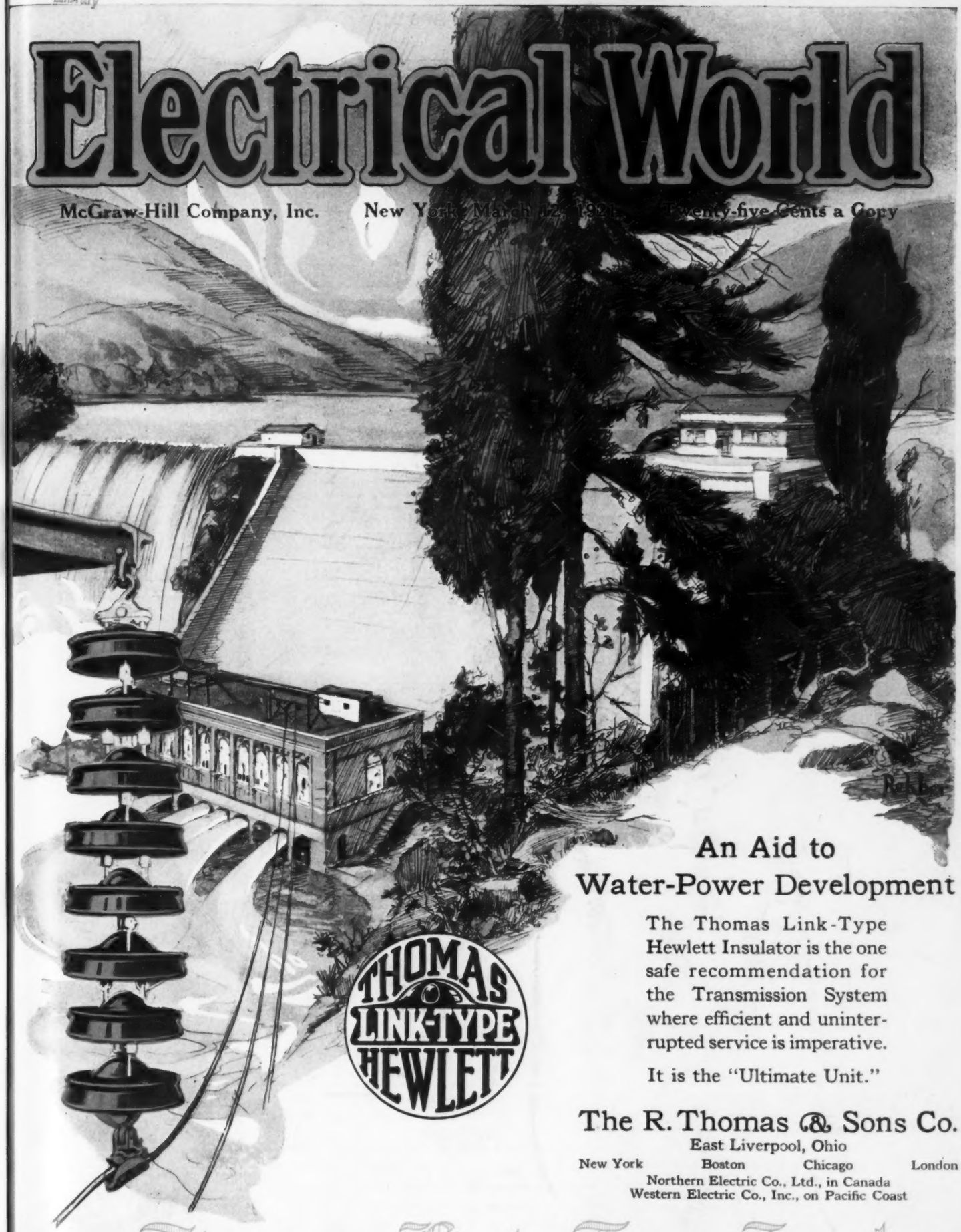

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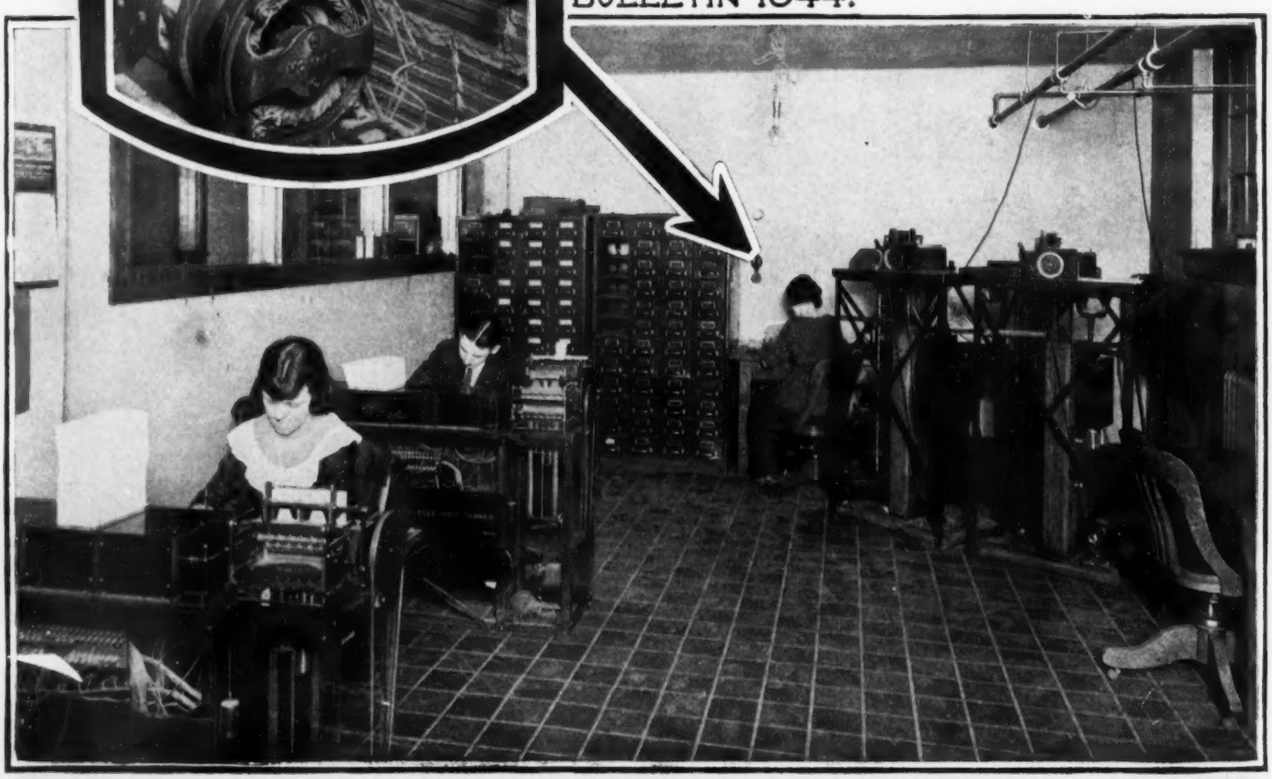

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Electrical World

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Importance of World's Markets to America

THE change in administration at Washington ought to bring about some beneficial changes to the nation. However altruistic we may be about these, we must not lose sight of the fact that we cannot meet or escape our obligations merely by that means. Neither can we effect economies—and heaven knows economies are sorely needed—by saving at the spigot and wasting at the bunghole. The nation's debts are met through taxes, and while our system of taxation may be faulty and changes in the excess profits tax are to be expected, yet, no matter how the burden may be spread out or adjusted, it is sure to weigh as heavily. Much as we might like to forget the war, we still must liquidate its costs. Within two years government war debts to the amount of over $7,000,000,000 mature, and the current expenses of the government are running at the rate of $5,000,000,000 a year. In fact, the internal tax collections and other current receipts are absorbed by current expenditures. Thus for some years to come internal taxes must net the government $4,000,000,000 annually and the fetish of government loans and bonuses must cease. The great task confronting the country is the reduction of the national debt. This means monetary deflation, and that is always to be feared because of its depressing effect on business. There is, however, a sensible way of bringing about monetary deflation without untoward effects, and that is by increasing our output enormously and maintaining earnings by this means on a lesser rate of profit. Prices will, of course, fall, but the total real wealth of the country will increase. An outlet will of necessity have to be found for our surplus product and the country's export trade must be expanded enormously. When the extent of our debts is finally realized, then, and probably not until then, will American industry and business appreciate as never before the importance of the world's markets to this country.

Pre-empting Commission Functions

IT IS an annual experience in legislative circles that advocates of bills introduce measures for consideration which, if passed, would withdraw from the regulating commissions a certain amount of jurisdiction over public utility matters. Unpopular commission decisions frequently lead to bills of this sort, and in their advocacy politicians find an outlet for attacks that yield at least a modicum of notoriety, and sometimes fame. At a hearing in Connecticut another aspect of this subject was presented by a representative of insurance interests who pointed out that if the State Legislature should pass a law prohibiting the use of the service charge the stability of investments in public utility securities made by insurance companies would be lessened. Such matters, it was contended, fall within the jurisdiction of the utility commission of the state, an expert tribunal competent to deal with these technical questions more satisfactorily than a general legislative body. There is no question that wise commission regulation tends to stabilize popular confidence in public utility securities, and by leaving to the commissions the task of determining the justice of particular or general rate structures and practices the probability of sound decisions is increased as compared with the treatment of these questions by a larger body composed of many individuals not possessing the special qualifications and experience required to deal promptly and equitably with them. The point made by the representative of the insurance companies is well taken, in our opinion.

Facing a Dilemma with Very Sharp Horns

WHEN the Muscle Shoals power project was undertaken early in 1918 it bade fair to yield important results under the then existing conditions. Now, however, different conditions have arisen. The entire $17,000,000 made available from the national defence funds for the construction of the plant will have been expended about June of the present year, despite the fact that it is now estimated to be only 30 per cent completed. The question is, shall more money be appropriated to give an immediate development of 100,000 kva. and a possible output of 700,000,000 kw.-hr. yearly, or shall the government stand the loss of the $17,000,000 already spent and give up the project? The government's action for the time being has been decided by the House of Representatives of the Congress just closed by its refusal to accept the Senate's amendment to the sundry civil appropriation bill granting $10,000,000 for the completion of the Wilson Dam at Muscle Shoals. The amendment was rejected by a vote of 193 to 182. Therefore, if anything is to be done to bring a return on the money already invested, new bills will have to be presented in the coming Congress. An exhaustive examination of the economic probabilities of this development is certainly needed, based now on roughly three times the original figure per kilowatt of output. The nitrate plant which formed a part of the original undertaking appears at first glance to be a vital part of the whole project, inasmuch as it would constitute a great and important outlet for secondary power. On the other hand, the whole problem of the fixation of nitrogen is rapidly being modified, so that to estimate the probabilities is no easy matter. With all this there stand out two fundamental facts—first, that it is bad judgment to drop $17,000,000 if there is a reasonable chance of pulling out of the investment on some decent sort of basis by continuing the

work; second, that it is certainly a pity to see the possibility of 700,000,000 kw.-hr. per year in primary power and possibly nearly twice as much in secondary power slip out of sight as a factor in the economic development of the country. We certainly hope that thorough investigation of the situation will show that it is the part of wisdom to go ahead, but the dilemma is unquestionably a very serious one.

A New Method of Measuring Flow in Pipe Lines

THE task of measuring the flow in penstocks, or its equivalent, the discharge of waterwheels connected thereto, has always been more or less troublesome, and hence the announcement of a new method which has the combined advantages of simplicity, high accuracy, speed and ease of application should be especially welcome to hydro-electric engineers. Such a method is explained and discussed on page 591 of this week's issue, particular emphasis being placed on its application to the measurement of diversion through the plants of the Niagara Falls Power Company. Aside from its commercial value in testing the efficiency of waterwheels and waterways and the possibility of applying it to continuous plant tests, the method is particularly interesting because of the principle involved. Stated briefly, it is that when water flow in a pipe line is retarded there is a rise in hydraulic pressure. Integrated over a time interval this change in pressure is a measure of the change in rate of flow.

Underpaid Professors and Other Engineers

CONCENTRATED efforts of universities and their alumni have been put forth during the past two years to raise large endowment funds to provide adequate salaries for their teaching staffs. Though much has been accomplished, it must be admitted that the goals striven for were usually not reached. Failure in that regard was somewhat alleviated by the sudden drop in business activity and the slow drop in prices. Nevertheless, it must be concluded that the public has not been roused sufficiently to the magnitude and the importance of the task and that continued effort will be necessary for complete success. Many plans are on foot, less spectacular perhaps than those previously tried, but, it can be hoped, foreshadowing satisfactory results.

There are, however, other places where the evils resulting from inadequate salaries are seriously impairing progress. One of these is on the engineering staffs of central-station companies. Just as in the case of their brothers in the teaching professions, these engineers have not known how to sell their services at a proper figure. Perhaps the fact that the public as a whole is wholly unable to gage the merits or the failings of a piece of engineering work is the cause of this condition. The fact remains that the engineering departments of central stations today are not attracting and developing the best engineers in the country. Worse still, electrical engineering as a means of making a living is not appealing to many ambitious and able young men who see richer pastures elsewhere, and some of the blame for this condition can be placed on the executives of central-station companies.

It would certainly be wisdom to educate the public to appreciate and to keep managers from forgetting the enormous difference between the capable engineer and the one who is satisfied with filling some minor clerical position. The first one will abound in new ideas; his efforts will accomplish economies, and he will be a leader in progress. The other may never bring a new thought to his work and may for years do the same thing in the same old-fashioned manner. No industry in the world has shown more public conscience than the central-station industry, to no industry has been given more confidence, for it is virtually without competition, and no industry should be more concerned with giving the best that is possible to those that it serves. Is it not the duty of the central-station industry to attract, develop and encourage the best engineering talent that is available?

Designing Stations with Reference to Load Factor

LOAD factor has always been somewhat of a nightmare to managers of central stations. The fundamental difficulty with proper design of stations for load-factor requirements is that load factor itself is definitely known only for particular epochs, up to the last for which data are available. In a certain sense one may extrapolate from such data and form at least a preliminary notion of what the load factor reckoned on a yearly, monthly or daily basis is likely to be for the next few years. During periods when the growth of station output is along definite and steadily increasing lines thus to forecast the future is comparatively easy. When, however, as in the last few years, there has been a radical change in the nature of station output, owing to an extraordinarily accelerated growth of industrial demand, it is no easy matter to judge for what future values one must be prepared.

The single definite fact which looms large in this matter is that the load factor is tending steadily upward like the cost of fuel, and hence on the whole preparation must usually be made for load factors higher than was indicated at an earlier period. Annual load factor has a far-reaching effect on fixed charges, which work all the year round, if not overtime, while the earnings are limited by the output. The effect of increasing load factor in keeping down in a general way the costs due to fixed charges may be demonstrated readily and is understood by all progressive central station engineers. There is another side to the question in that preparations for operating at a high load factor in the most economical way are expensive, so that too strenuous efforts at preparing for the future may temporarily prove uneconomical.

The extent to which central-station location is affected by load factor is not as familiar as it should be. In a first-class plant condensing water is so important a matter that it often outweighs other considerations in station location. There are, however, situations, particularly when operating under unfavorable load conditions, when a different design of station, perhaps with artificial cooling of the condensing water, might prove economical. Here again future growth is an all-important matter, for granting that a plant planned for artificial cooling might easily become uneconomical, its period of usefulness might easily extend to a time when the heavy load would be carried by a station designed for the highest possible efficiency, and the older plant might then serve only for emergency and peak work. In settling all these matters the daily load factor may prove to be quite as important as the yearly

figure, especially with respect to choice of the number and size of units, which again bear an uncertain relation to the future.

We are inclined to think that year by year difference in cost between a highly efficient station and one built with a keen eye toward fixed charges is likely to diminish, as experience is gained and builders of equipment more and more thoroughly standardize that of the higher efficiency. The size of units, steam pressure, superheat and various devices for economy have progressed regularly toward better standards, and with the swiftly growing demand for electrical energy there will be less and less occasion to build for minimum first cost. Even in the specific case where this is most often advisable, the construction of auxiliary stations for use with water power, experience indicates that the load factor steadily tends to drift upward.

Temperature Limits in Electrical Machines

IT IS interesting to note that the matter of high operating temperatures is being investigated both in this country and abroad. A recent paper presented before the British Institution of Electrical Engineers gives details of various tests made on class B insulation for which the general standard maximum temperature is 125 deg. C. These data were obtained as the result of tests on samples fitted in the slots of a standard machine and worked far beyond a regulation degree of final temperature. The actual figures were obtained by thermocouples placed directly on the copper. The tests were made with insulations made of fabrics and mica, paper and mica, and mica and shellac alone, and extended over a period of 7,000 hours at a steady temperature of 190 deg. C. After this protracted period, during which tests for insulation failure were daily made, the samples were submitted to a final voltage test for breakdown. The ultimate result was to show that the straight mica insulation held up to 50,000 volts, the normal voltage applied in the operating tests being 11,000. The composite insulators of the better class all held up above 30,000 volts, ranging as high as 50,000.

American engineers and designers as a whole have consistently taken the conservative side in all matters of operating temperature, which is perhaps one of the reasons for the extremely good reputation of American electrical machinery. More experience than that obtainable from tests already made would seem to be necessary prior to any general change of practice. Such may come later, but considering the large stake in the operation of big turbo-generators it would seem wise to "play safe" for some time to come.

Charging Current on Pit River Lines Sets Lower Limit of Generator Rating

TWO points brought out by A. H. Markwart in his article in this issue describing the Pit River project of the Pacific Gas & Electric Company should be of considerable interest to electrical engineers. The first is that the transmission lines are being designed to operate ultimately at 220,000 volts. This voltage has not been selected for any arbitrary reason, but because it offered the greatest economy in design and operation. It is understood that the lines will later carry approximately 150,000 kw. per circuit, which over the distance of transmission required is feasible only by the use of lines of this voltage. In addition to the economies of transmission there is always present the vital factor of right-of-way costs. By the use of double-circuit steel towers operating at 220,000 volts the total number of circuits transmitting the power from this project will be about four, whereas the use of a lower voltage would require considerably more circuits at a proportionately greater expense for right-of-way.

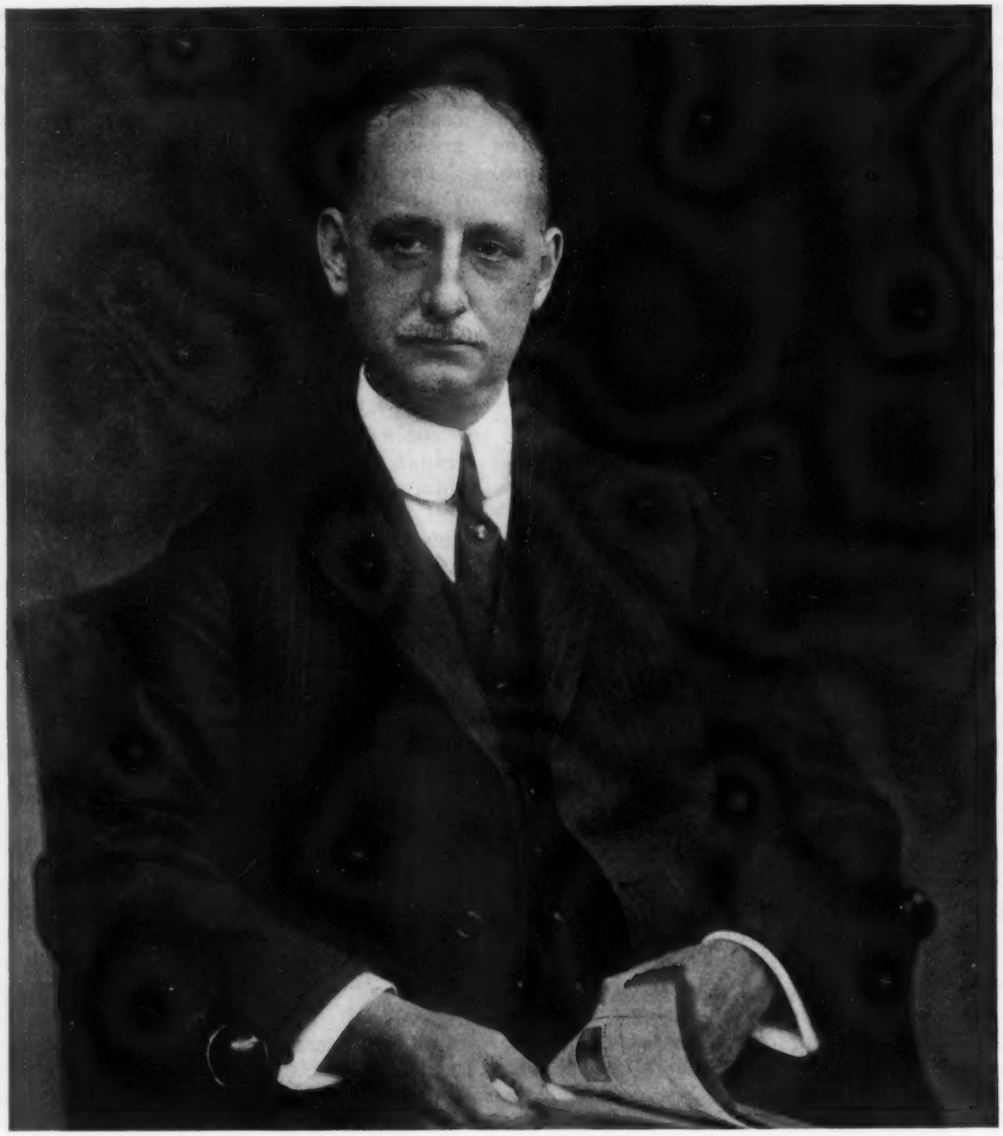
The second point of particular interest is that generators of a rather large size are being installed. The size of the generators is dictated largely by the voltage and length of the transmission lines, which require high kvas. for energizing them. In fact, in all large hydroelectric projects transmitting power over long distances at high voltages the charging current is a factor that determines the lowest limit of size of generators which can be utilized. Although a multiplicity of units of smaller size has some operating advantages in that a shutdown of one unit does not materially cripple the output, and although a satisfactory safety factor may be obtained by the installation of another of the smaller units at a proportionately less price than by the installation of a larger unit, yet the constants of the transmission line are the controlling factors and necessitate the use of large units.

International Electrical Communication

THE international conference on electric communications recently held at Washington, D. C., under the auspices of the State Department, was a necessary preliminary to a more generally international conference of the same type, to be held probably this year in Paris. A noteworthy feature of this conference was that for the first time in history it brought together, with great mutual advantage, representatives of wire and radio telegraph and telephone communication and also of visual signaling. In future it will probably be impossible to have separate conventions in any of these activities. At first thought flag signaling at sea might be regarded as dissociated from electric communication. Yet it is to be remembered that flag signaling may happen to be the last link in a message-transmission chain.

It is expected that a technical international council will be established under the forthcoming international convention to consider and recommend future world-communication developments. A technical international committee is also expected to be formed to advise upon technical questions in world communication.

As we understand the matter, the proposed international council and technical committee possess advisory powers only and are to have no executive functions. Perhaps that is a necessary condition at the outset. In the course of time, however, it will probably be necessary to invest either these or some other international body with executive powers for the policing of the ether. If international radio rules could always be obeyed, or if their infractions could always be promptly dealt with by the individual countries wherein they occur, then no internationl executive powers would be necessary. Such, however, is not yet the case in this possibly not best of possible worlds. It is therefore likely to be necessary for the various countries to agree before long upon the creation of an international communication police to help maintain world order in the atmosphere around the world.



Frank Whitney Smith

A vice-president of the N. E. L. A., and a central-station executive whose career embraces more than forty years of service in one organization in the development of alternating-current distribution in New York City

SEVEN years ago when The United Electric Light & Power Company of New York City placed in operation its Sherman Creek steam station, rated at 151,600 kw., it was expected to take care of the load until 1935. Conditions which were then unforeseen have now forced the company to start another plant, one of the largest in the country, with an ultimate capacity of 280,000 kw. The marked development of upper Manhattan Island during this time and a constructive policy in the extension of electric service facilities under the management of Frank W. Smith are reflected in such strides in station ratings. The history of this company embraces Mr. Smith's entire career. When thirteen years old he became office boy of the old United States Illuminating Company, the predecessor to the United company, and steadily advanced to the position which he now occupies as vice-president and general manager.

During his forty years of service in the central-station field Mr. Smith has applied his great energy and business acumen in administrative matters with telling results, significant among which is the fact that his company serves 70,000 customers, who in 1920 purchased 420,000,000 kw.-hr.

Likewise, Mr. Smith has been a builder in the industry to whom others have looked for whole-hearted co-operation in pushing any forward movement. He has been an active proponent of the electric vehicle and was the third president of the old Electric Vehicle Association of America. In reorganizing the N. E. L. A. along broader lines of activity Mr. Smith has taken an active part and at the present time he is its second vice-president. For a number of years he has headed the association's lamp committee, the annual report of which is a comprehensive chronicle of vital facts relating to electric lighting. Through this committee he is taking a very active part in the much-needed standardization of lamp voltages.

Mr. Smith was born in Alden, N. Y., June 22, 1867. From the time he was thirteen he has been continuously in the service of one organization. His first big advancement was to general clerk and then to paymaster. In 1891 he was made assistant auditor and eight years later he was elected assistant secretary of the company. In 1905 he became secretary and eleven years later was elected to the combined office of vice-president and general manager.

During Mr. Smith's administration of the affairs of the United Electric Light & Power Company he has built the Sherman Creek generating station already mentioned, which supplies 60-cycle service throughout the boroughs of Manhattan, Bronx and Queens and in part of Westchester County and also 25-cycle service for the New York, New Haven & Hartford and the New York, Boston & Westchester railroad companies. He has also built three substations in upper New York, including the one at West Farms through which the railway service is delivered, besides a substation on West Forty-fifth Street and a modern display and service building uptown in New York.

Half Million Horsepower from Pit River

Contemplated Development Exceeding 450,000 Kva. in Northern California Will Utilize Flow of Unique Stream—First Station Now Under Construction—Line Being Built for 220,000 Volts

By A. H. MARKWART
Director of Engineering Pacific Gas & Electric Company, San Francisco, Cal.

THE Pacific Gas & Electric Company is now starting on a program which involves the ultimate development of a continuous output of about 322,000 kw. on the Pit River in northern California. The installed capacity will be upward of 450,000 kva., and in the next ten to thirteen years an expenditure of more than $90,000,000 will have been made to generate and transmit 3,000,000,000 kw.-hr. of hydro-electric energy annually to the northern and central parts of the state. This sum does not include the expenditures for distributing the energy to the farms, homes and industries of California. A study of the kw.-hr. output of this company from 1911 to 1920, inclusive, reveals a growth of about 100 per cent. If this growth continues, and after making due allowances for increases resulting from the acquisition of various electrical properties, this increase carried forward indicates that the output, which was almost 1,500,000,000 kw.-hr. in 1920, will be about 3,000,000,000 kw.-hr. in 1929. An inspection of the load factors of the past shows that the 65 per cent which has been attained is not likely to be exceeded in the immediate future. Using this load factor in connection with future growth the average and peak loads, which were 168,000 and 259,000 kw. in 1920, will be 343,000 kw. and 526,000 kw. respectively in 1929. To meet this increase there is under way the comprehensive development of Pit River.

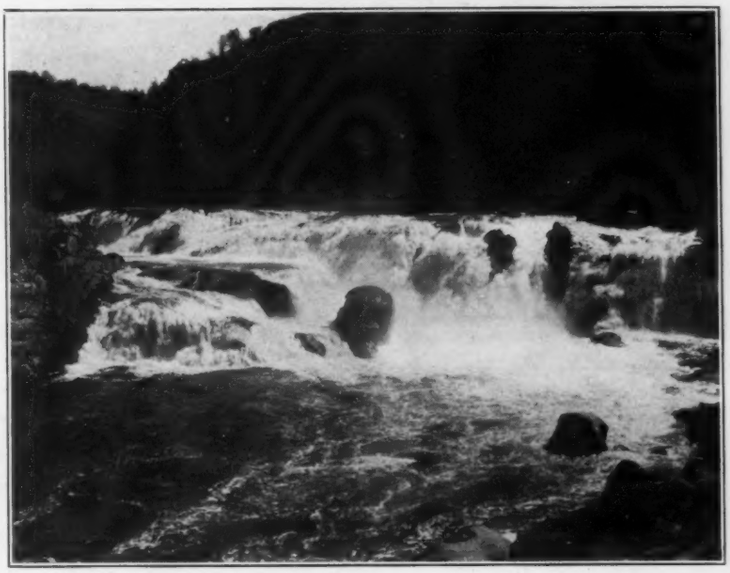


FIG. 1—FALLS ON PIT RIVER NEAR FALL RIVER MILLS

This unique river drains a basin of about 6,000 sq. miles (15,300 sq.km.) in Modoc, Lassen, Siskiyou and Shasta Counties, as shown in the accompanying map. Its principal tributaries are Fall River, Hat Creek, Burney Creek and the McCloud River. The basin is largely of volcanic structure and has varying amounts of annual precipitation, approximately as follows: The plateaus from 14 in. to 18 in. (35 cm. to 45 cm.), the lava areas from 18 in. to 34 in. (45 cm. to 90 cm.), and the mountains from 30 in. to 60 in. (75 cm. to 150 cm.), the maximum obtaining in the mountainous region on the headwater of the McCloud River. The run-off is a minimum in the plateau areas and a maximum in the mountainous areas. Although the porous lava areas and the mountain areas produce the bulk of the flow, the former is under much better regulation. The run-off in the basin streams is relatively uniform and is unlike the usual California streams, only the McCloud being similar. Recently, during several days of comparatively heavy precipitation, Hat Creek, Burney Creek and the Pit River below Fall River Mills showed no appreciable rise.

Altogether the Pit River is remarkable for its natural regulation, this being brought about by the existence of the many springs and subterranean flows originating in underground reservoirs occurring in the porous areas of Fall River, Hat and Burney Creeks. Some curious conditions prevail. Records of the flow of Fall River at Fall River Mills show an average annual run-off of 1,020,000 acre-ft. (1,254,600,000 cu.m.), which is equal to 28 in. (71 cm.) per year over the apparent drainage area of 676 sq. miles (1,750 sq.km.). This exceeds the actual average annual precipitation by 4 in. (10.4 cm.). From this it is apparent that there are large flows into the Fall River from other areas.

The Pacific Gas & Electric Company contemplates the full development in the basin from a point on Fall River above Fall River Mills to a point on the Pit below the "Big. Bend," a distance along the streams of 60 miles (96 km.). The total fall is 2,104 ft. (640 m.), of which it is expected to utilize 2,074 ft. (631 m.) in at least five stations. The area of the watershed above the diversion of the lowest proposed plant is 4,809 sq. miles (12,450 sq.km.). The discharge of the Pit at Henderson, a few miles below this diversion, is shown in the table. The minimum daily flow is 2,010 sec.-ft. (56 cu.m. per second) and the maximum 13,300 sec.-ft. (370 cu.m. per second). It is tentatively proposed to install at a point below Pecks Bridge a storage reservoir of sufficient capacity to regulate the river below to such a flow as may be desired. The hydrograph indicates that a storage of 62,000 acre-ft. (76,000,000 cu.m.) will regulate the river to 2,500 sec.-ft. in all but exceptionally dry years. Below this storage will be built at least three of the five stations. Above this reservoir there will be two plants, the upper one of which, Pit River No. 1, is now under construction and receives an average low flow of 1,400 sec.-ft. (39 cu.m. per second) from Fall

River. The lower station (Pit River No. 2) will use an average low flow of 1,500 sec.-ft. (42 cu.m. per second). In addition to the development of the Pit, two stations are now going in on Hat Creek. These will utilize substantially all the drop existing from the Hat Creek Valley to the Pit. Future plans contemplate increase in flow of Hat Creek which will benefit both plants on that stream.

At Hat Creek No. 1 the diversion is by means of a timber and rock-fill crib. Water control is by motor-operated radial gates. Protection against floating drift is effected by means of a floating boom of timber. The conduit connecting the diversion and forebay is a ditch having a bottom width of 17 ft. (5.18 m.) and a width at water surface of 45.5 ft. (13.8 m.) at a 9.5 ft. (2.8 m.) depth. The ditch is 2,750 ft. (838 m.) long, is excavated in lava rock and is head is 212.8 ft. (64.8 m.). The maximum power with 600 sec.-ft. (16.8 cu.m. per second) is 9,300 kw. For this condition the effective head is 210.5 ft. (64.2 m.). The high kva. rating of the generator is necessitated by heavy line charging current.

Excitation is derived from an impulse-wheel-driven 250-volt, 175-hp. exciter. The power is transmitted over a single-circuit line to Hat Creek No. 2, at the generator voltage, 6,600 volts, without transformation. This line is of 500,000-circ.mil copper cable and has lightning arresters at both ends.

Step-up Transformers at Hat Creek No. 2

The diversion for Hat Creek No. 2, down stream from Hat Creek No. 1, is effected by means of a pile and timber structure. The spillway is 282 ft. (85.9 m.) long. Water control and protection from drift are

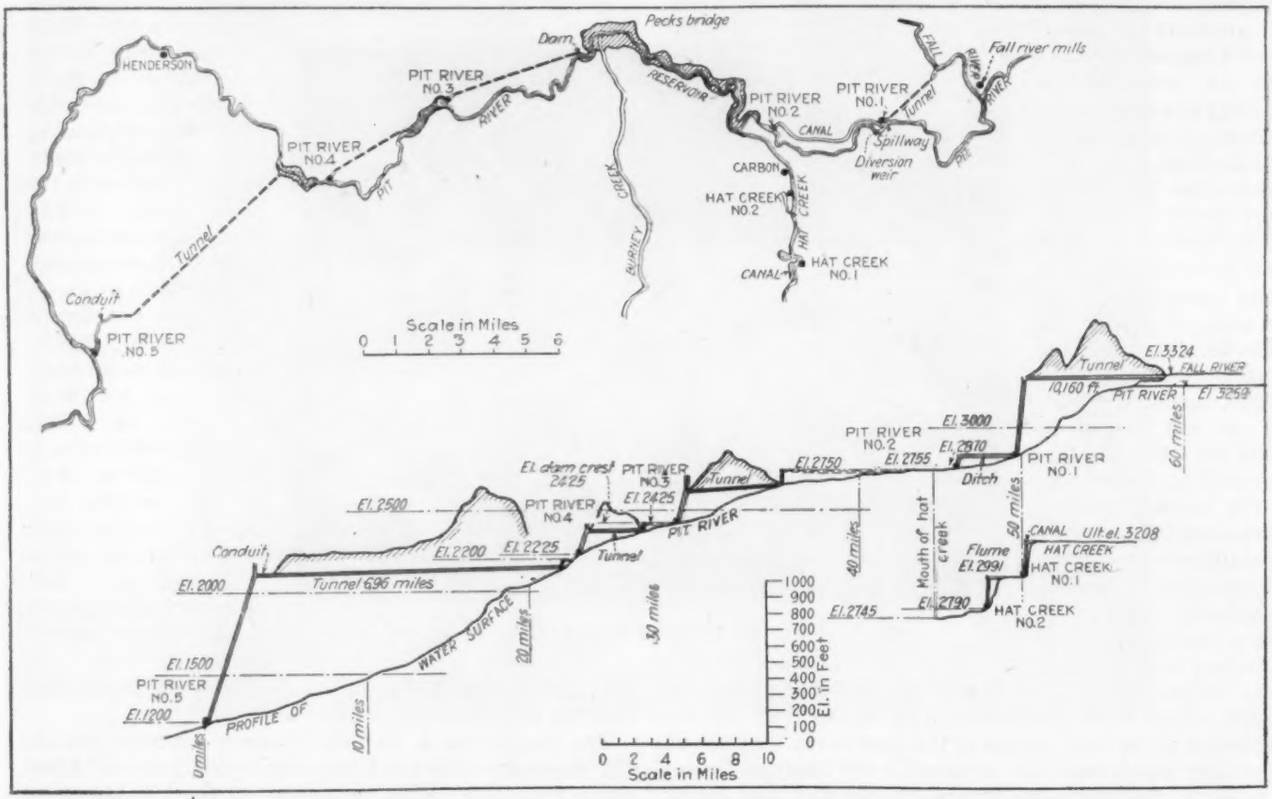


FIG. 2—COMPLETE UTILIZATION OF 2,070-FT. DROP IN PIT RIVER WILL BE ACCOMPLISHED IN NOT LESS THAN FIVE STATIONS (SEE TABLE BELOW)

constructed on a grade of 0.25 ft. per 1,000 ft. The excavated forebay has a nominal capacity of 12.5 acre-ft. (15,400 cu.m.). The penstock consists of a riveted pipe 1,700 ft. (518 m.) long, the diameter ranging from 10 ft. (3.04 m.) at the top to 8 ft. (2.43 m.) at the bottom, and has a 7.5-ft. (2.28-m.) turbine inlet. The maximum drop is 216.8 ft. (66.1 m.) from headwater to tailwater. The comparatively long penstock required the installation of a pressure regulator, which will discharge approximately 80 per cent of the maximum flow. A butterfly stop valve connects directly to the turbine inlet.

A reinforced-concrete building houses the hydraulic and electric equipment. The station contains one 15,000-hp. vertical turbine directly connected to a 12,500-kva. generator and operates at 225 r.p.m. With a normal flow of 450 sec.-ft. (12.6 cu.m. per second) this unit will develop 6,650 kw. Under this condition the effective

Station	Intake Water El.	Tail-water El.	Ave. Low Flow Sec.-Ft.	Total Head	Ave. Hp. Available
Hat Creek No. 1.....	3,208.5	2,991.7	400	216.8	7,900
Hat Creek No. 2.....	2,991.7	2,790.4	600	201.3	10,200
Pit River No. 1.....	3,324.0	2,870.0	1,400	454.0	60,500
Pit River No. 2.....	2,870.0	2,755.0	1,500	115.0	15,400
Pit River No. 3.....	2,750.0	2,425.0	2,500	325.0	73,500
Pit River No. 4.....	2,425.0	2,225.0	2,500	200.0	46,500
Pit River No. 5.....	2,200.0	1,220.0	2,500	980.0	215,000
Total.....					429,000

similar to those used at Hat Creek No. 1. From the diversion to the head of the penstock a 4,469-ft. (1.362-m.) flume has been built on an excavated bench.

The flume is of timber, is 16.3 ft. x 7 ft. (4.9 m. x 2.1 m.) in dimensions and will carry 800 sec.-ft. (22.2 cu.m. per second) at the grade of 0.7 ft. per 1,000 ft. A spillway 550 ft. (167 m.) long is tentatively planned for the side of the flume at the lower end. The flume

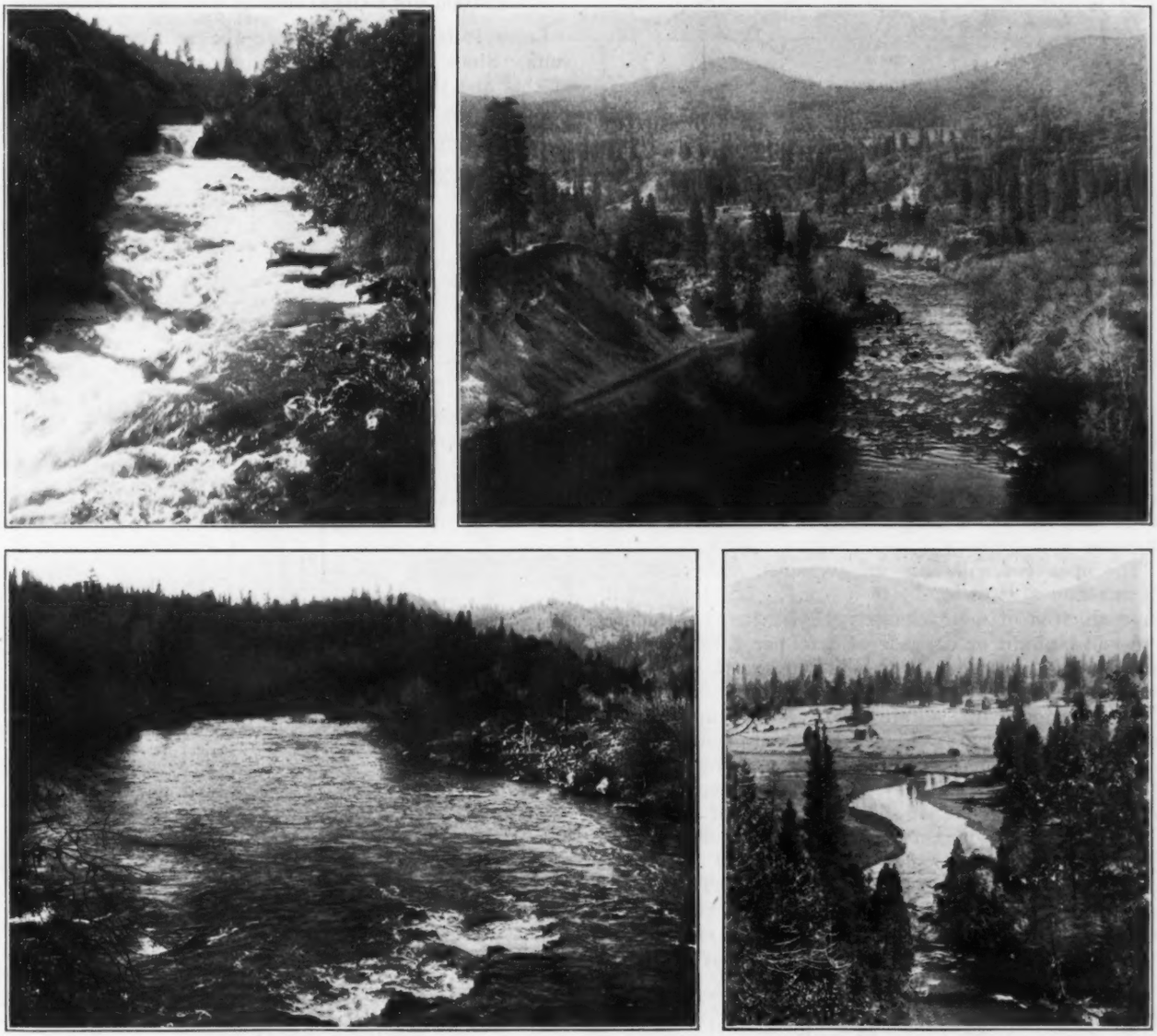
terminates in a concrete-lined forebay of negligible capacity, which is equipped with radial gates as at Hat Creek No. 1. The riveted steel penstock is 400 ft. (122 m.) long and of the same general diameters as Hat Creek No. 1. The head is 201.30 ft. (61.3 m.).

The power-house equipment is identical with that provided for Hat Creek No. 1, with two exceptions—transformers are added to raise the generator voltage to the present line voltage of 60,000 and there is no pressure regulator and stop valve as the penstock is short. These may be installed later if operating conditions require them. With a normal flow of 600 sec.-ft. (16.8 cu.m. per second) 8,630 kw. will be generated under an effective head of 195.8 ft. (59.5 m.). The maximum power with 800 sec.-ft. (22.4 cu.m. per second) is 11,200 kw. with 194.5 ft. (59.3 m.) head.

The four outdoor water-cooled transformers (one a spare) at Hat Creek No. 2 are rated at 8,000 kva. and will be wound for 6,600/63,000 volts delta. They will step up the output of the two stations from 6,600 volts to 60,000 volts for transmission to Cottonwood, where it is to be delivered to the reconstructed lines of the former Northern California Power Company for transmission further south. This line voltage will be increased later to 110,000 and finally to 220,000.

PIT RIVER NO. 1 WILL HAVE TWO 35,000-KVA. UNITS

Owing to the size of the generating units, Pit River Station No. 1 is perhaps the most interesting. The two units, which are rated at 35,000 kva. each, will be exceeded in size only by the 45,000-kva. generators under order for the Canadian Niagara Company. Pit River No. 1 diversion will be on Fall River about three-quarters of a mile above Fall River Mills. The diversion structure tentatively decided upon will be a pile erection of the same general design as that provided for Hat Creek No. 2, the idea being to replace it after the completion of a tunnel by a concrete structure. Storage is not provided, and the whole minimum flow of the river will be diverted by means of a conduit consisting of



FIGS. 3, 4, 5 AND 6—STREAMS THAT WILL YIELD NEARLY HALF A MILLION HORSEPOWER

Upper left—Falls on Hat Creek below intake for Hat Creek No. 2 station. Upper right—Pit River at Henderson gaging station. Lower left—Pit River No. 1 station will be built on right of stream at bend. Lower right—Site of Hat Creek No. 2 station near Carbon.

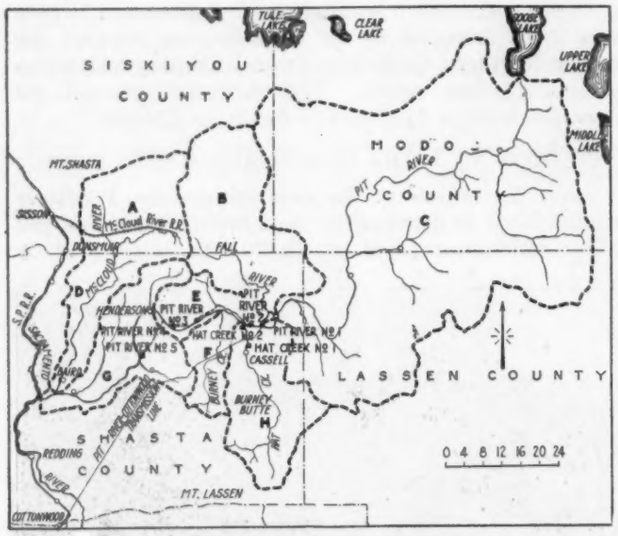


FIG. 7—AREA SURROUNDING PIT RIVER
Records of total annual run-off, precipitation and drainage area indicate a subterranean flow into the basin.

	Drainage Area in Sq. Miles	Average Yearly Run-Off in Acre-Ft.
A	644	1,642,000
B	676	1,020,000
C	3,320	662,000
D	257	593,200
E	200	.....
F	153	121,700
G	453	1,116,000
H	460	475,000

1,150 ft. (350 m.) of open cut and 10,160 ft. (3,100 m.) of tunnel, the latter terminating in a combined surge chamber and spillway.

The open cut will have an average width of 60 ft. 18 m.) and a depth of 10 ft. (3 m.). The tunnel will have an area of approximately 154 sq.ft. (14.3 sq.m.) and will be built on a grade of 3 ft. per 1,000 ft. The capacity of the conduit will be 1,800 sec.-ft. (50 cu.m. per second).

The station will contain two vertical units of a maximum capacity of 40,000 hp., each connected to a 35,000-kva. generator running at 257 r.p.m. The output with 1,500 sec.-ft. (42 cu.m. per second) will be 64,500 hp. under an effective head of 429.3 ft. (130.8 m.). The maximum output with 1,800 sec.-ft. (50 cu.m. per second) flow will be 73,800 hp. under an effective head of 418.2 ft. (127.6 m.). The generating voltage is 11,000. In addition to the direct-connected exciters there will be a spare motor-driven exciter. The latter has an extended shaft opposite the motor end on which is mounted an impulse wheel for emergency operation.

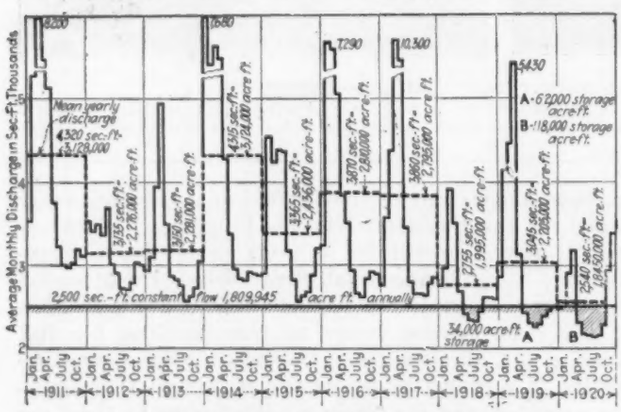

Average Monthly Discharge in Sec.-Ft. Thousands
Mean yearly discharge 4320 sec.-ft. 3,128,000
2500 sec.-ft. constant flow 1,809,945 acre ft. annually
34,000 acre ft. storage
A-62,000 storage acre-ft.
B-118,000 storage acre-ft.
Jan. Apr. July Oct.
1911 1912 1913 1914 1915 1916 1917 1918 1919 1920

FIG. 8—ANNUAL AND MONTHLY FLOW OF PIT RIVER SHOWING STORAGE REQUIRED

Power from Pit River No. 1 will be transformed from 11,000 volts to 110,000 volts for transmission to the San Francisco bay district. At the time this station is placed in operation the transformers at Hat Creek will be connected for operation at 110,000 volts and a connection will be made to the Pit River No. 1 line. The seven transformers at Pit River No. 1 will be rated at 16,667 kva.

220,000-Volt Operation Is Contemplated

Later it is planned to raise the voltage to 220,000 volts. Since the transmission lines receiving the ouput of this and the Hat Creek stations will be operated at 110,000 volts for some time, it may prove inadvisable at this time to make the costly investment in 220,000-volt switching equipment.

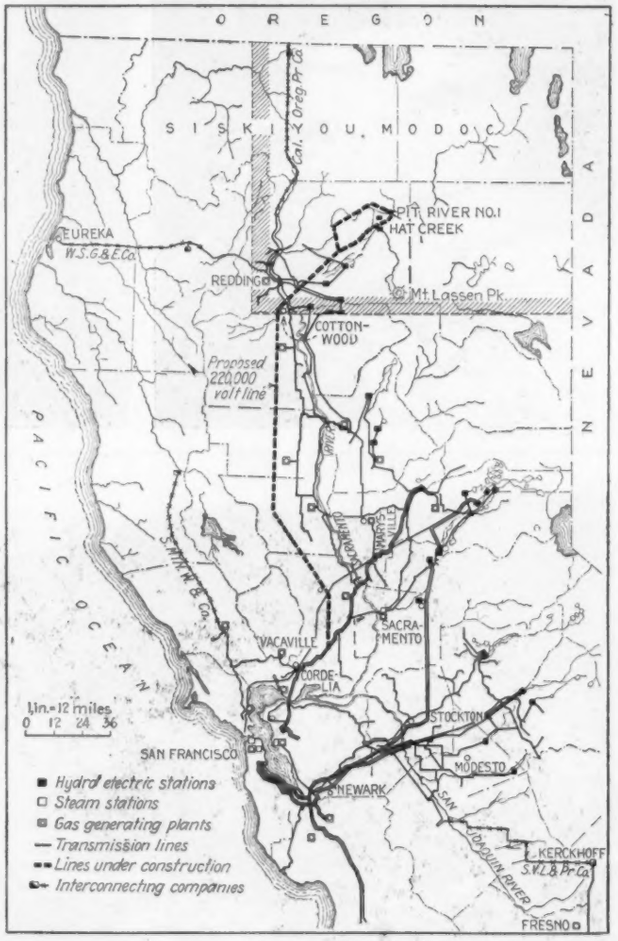
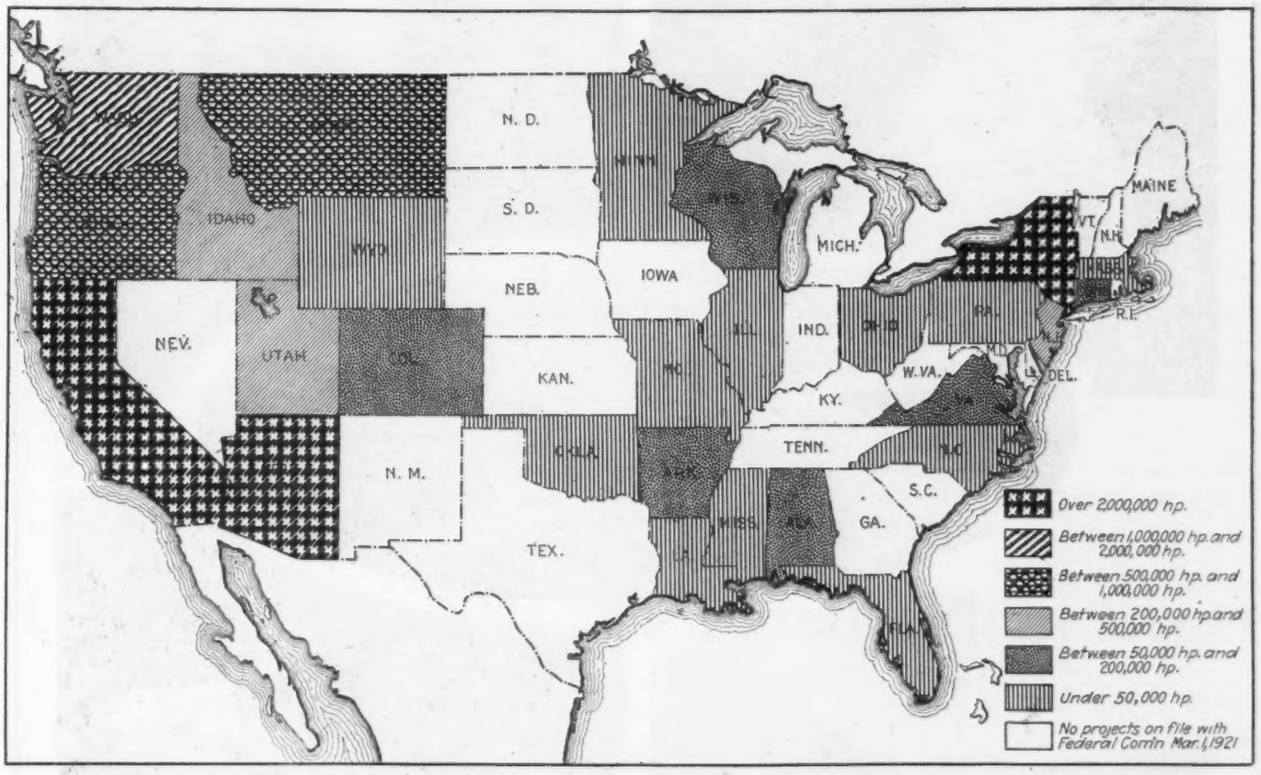


FIG. 9—RELATION OF PIT RIVER PROJECT TO PACIFIC GAS & ELECTRIC COMPANY SYSTEM

It is expected that 110,000-volt operation will continue until Pit River No. 3 station is completed, when additional line capacity will be required. To meet this condition the line voltage will be raised to 220,000 volts. At that time the 110,000-volt transformers at Hat Creek No. 2 will be removed and the power will be transmitted to Pit River No. 1, where it will be delivered to the 11,000-volt bus of that station and there transformed to 220,000 volts. It is expected that the 220,000-volt operation will be initiated in 1924, and the towers, conductors and insulation are being constructed now for operation at that voltage.

Applications for Preliminary Power Permits Continue to Grow

Federal Power Commission Reports the Receipt of 178 Up to Feb. 26—Ten Applications Filed During Month of February—Applications on File Involve Development of 13,725,166 Hp.



MAP SHOWING PROBABLE DISTRIBUTION AND INTENSITY OF HYDRO-ELECTRIC DEVELOPMENT IN THE UNITED STATES DURING THE NEXT DECADE

ON FEB. 26 1921, applications for permits or licenses on file with the Federal Power Commission under the federal water-power act numbered 178. A compilation from the data set out in the applications indicates that 13,725,166 hp. will be developed if the plans of the promoters are carried to completion.

The projects now under application range all the way from a small 10-hp. plant for a colony of summer cottages in the Wyoming mountains to the 3,570,000-hp. project of the Southern California Edison Company on the Colorado River in Utah and Arizona, which involves the storage of the waters of the upper Colorado River and its tributaries in a huge reservoir and a total hydraulic fall of 2,650 ft. (800 m.)

A general idea of the magnitude of the almost 14,000,000 hp. of contemplated hydro-electric development may be gained by considering that, if properly applied, it would furnish sufficient power for twenty-two cities the size of Chicago. It is probably 50 per cent more than the present water-power development in the United States and over 50 per cent of the present developed water powers of the world.

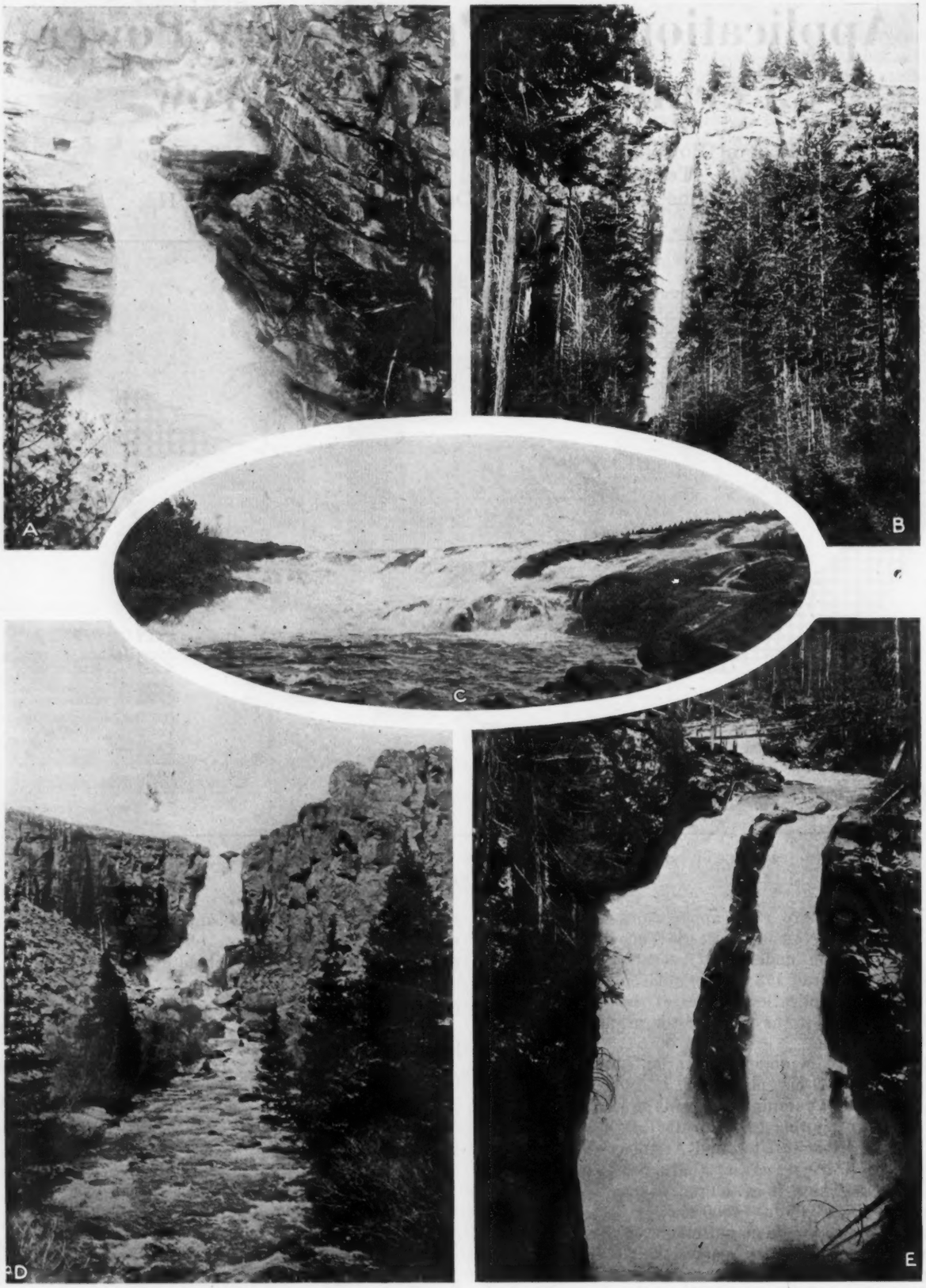
The development of the projects now on file, if carried to completion, will directly and indirectly result in the expenditure of more than eleven billion dollars for equipment and labor, distributed as follows:*

Cost of new generating-plant capacity—11,330,000 × $200	$2,266,000,000
Cost of transmission equipment—11,330,000 × $110	1,246,300,000
Cost of distribution equipment—9,200,000 × $100	920,000,000
Cost of customers' lamps, motors and appliances and of wiring houses and factories—9,200,000 × ($125 × 6)	6,900,000,000
Total capital required for probable hydro-electric developments and resulting service equipment	$11,332,300,000

While some of the projects doubtless represent only the hopes of the applicants, a very considerable proportion of them will eventually be developed. Some of the larger ones will be constructed in stages, the work extending over a period of years as market requirements

*For details of basis for these estimates see page 9 of the ELECTRICAL WORLD, Jan. 1, 1921.

National Forest Waterpowers Probable of Immediate Development



A—Tallulah Falls, Tugaloo River, Savannah National Forest, Ga. About 64,000 horsepower possible of development.

B—Rainbow Falls, Chelan National Forest, Washington.

C—Looking from Curtain Falls into Iron Lake, Superior National Forest, Minn. These falls are included in a power project for which application for preliminary permit has been filed with the Federal Power Commission. About 6,000 horsepower possible of development.

D—Clear Creek Falls, Rio Grande National Forest, Col. These falls and rapids are included in a power project for which application for preliminary permit has been filed with the Federal Power Commission. About 11,000 horsepower possible of development.

E—Nocksack Falls, Nocksack River, Washington National Forest, Wash. About 3,300 horsepower possible of development.

Photos by U. S. Forest Service

demand. The applications indicate, nevertheless, a movement of capital toward water power as a reconstruction measure which at this time of depression in industrial, building, agricultural and other lines is significant.

The accompanying map shows the probable distribution and intensity of hydro-electric development in the United States during the next decade as indicated by the applications for power permits now on file with the Federal Power Commission. The 6,865,088 hp. credited to projects in California and Arizona, virtually all the energy resulting from the development of which will probably be used in California, is about five times the estimated new water-power development necessary to supply the total increased electrical energy market of California by 1930. On the other hand, the 2,883,750 hp. concerned in projects in the State of New York is only about 650,000 hp. in excess of the estimated increased rating of central generating stations necessary to accommodate the increased factory and manufacturing load of that state by 1930, and is more than 1,000,000 hp. less than the estimated total increase in rating of central generating stations necessary to meet all requirements of both light and power customers of the Empire State by 1930. It would appear, therefore, that while the Mountain and Pacific States have by far the greater proportion of horsepower involved in contemplated hydro-electric projects, yet it does not necessarily follow that the field of greatest immediate hydro-electric activity will be confined to that section of the country. Hydro-electric development will follow and not precede the market for electrical energy, and highly industrial sections of the country possessing available water powers may be expected to become the most immediate fields of intensive hydro-electric development activities.

In the table above is a list of the applications for preliminary power permits filed with the Federal Power Commission from Jan. 29, 1921, to and through Feb. 26. Lists of applications filed prior to Jan. 29 appeared in the ELECTRICAL WORLD of Jan. 1, Jan. 15 and Feb. 12.

LOCATION AND SIZE OF WATER POWER PROJECTS FOR WHICH APPLICATION FOR PRELIMINARY PERMITS WERE FILED WITH THE FEDERAL POWER COMMISSION FROM JAN. 29, 1921, TO AND THROUGH FEB. 26, 1921

Name of Company	Location of Project	Capacity, Hp.
CALIFORNIA:		
Marcus Pluth, 424 Wilcox Bldg., Los Angeles	North and south forks of Whitewater River	.....
Harrison Albright, et. al., Laughlin Bldg., Los Angeles	Tahquitz, Snow and Little Morongo Creeks and Whitewater and Mission Rivers	5,100
Southern California Edison Company, Edison Bldg., Los Angeles	Transmission line	.....
San Joaquin Light & Power Corpn., Fresno	North and west forks of King River	188,260
Escondido Mutual Water Co., care H. Hawgood, Hellman Bldg., Los Angeles	San Luis Rey River and Bear Valley Creek	625
San Joaquin Light & Power Corpn., Fresno	Kern River	.....
WASHINGTON:		
E. N. Tunin, Keechelus Inn, Hyak, Wash	Wolf Creek at Lake Keechelus	.....
LOUISIANA:		
Louisiana Gravity Canal Company, care Wellman Bradford, Alexandria, La	Bayou Cocodrie	15,000
CONNECTICUT:		
The Connecticut River Co., 50 State Street, Hartford, Conn	Connecticut River at Kings Island	32,000
FLORIDA:		
The Ocklawaha Reclamation Farms, care of J. D. Young, Ocala, Florida	U. S. Government lock and dam on Ocklawaha River, Marion County, Fla	.....

Completion of Muscle Shoals Plant Urged

No Appropriation Made for Army Engineers to Continue Work on the Fifty-Million-Dollar Wilson Dam on Tennessee River at Muscle Shoals—$17,000,000 Has Already Been Expended

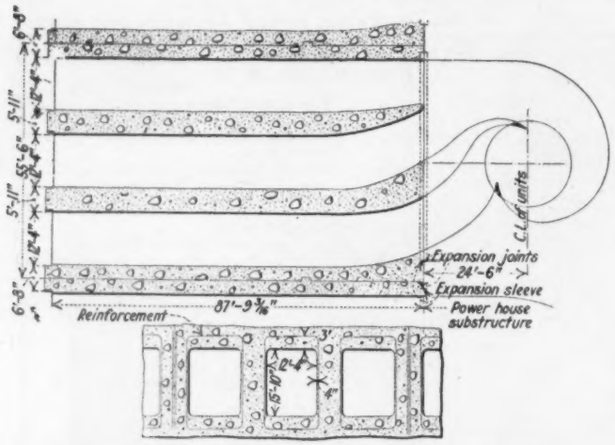
WITH 1,000,000 cu.yd. of concrete still to be poured and a schedule of operations calling for nearly 40,000 cu.yd. of this to be placed each month, the Engineer Corps of the Army seems to have a splendid argument for the appropriation of $10,000,000 which was requested in the last Congress for the work of the fiscal year beginning July 1. However, this appropriation was not granted and, therefore, this project, one of the largest ever undertaken by the federal government, will have to stand as now only 30 per cent complete until further appropriations are available. If the appropriations had been made as requested it was expected that the entire project would be so far developed as to begin generation of energy within three years. However, unless an item for this work is added to the army bill, which remains over for the new Congress, the work may be indefinitely delayed.

This project was really a war-time measure, for it was first authorized by the President when he set aside $13,000,000 from the national defence funds on Feb. 23, 1918, and authorized the construction of the dam and power house. Subsequently $4,000,000 additional was made available from these national defence funds, but it is believed that this amount will be entirely expended by June of the present year. The urgency of the request for the additional $10,000,000 to continue work during the following year is, therefore, evident.

The entire project as thus far authorized is now estimated to cost between $45,000,000 and $50,000,000. The original estimates of $17,000,000 to $20,000,000 were based upon the pre-war cost of labor and materials. As stated by General Taylor in commenting upon this situation, the original cost contemplated good labor at $1.50 per day, whereas now a minimum of $3.60 per day is paid for relatively poor labor. Corresponding increases in costs of cement and other materials which contribute largely to the total have also occurred, so that the present total estimate represents simply the original sum transformed into present cost units.

SCOPE OF THE PROJECT

The proposed dam and power house is a structure 4,200 ft. (1,280 m.) long, situated on the Tennessee River 2.7 miles (3.5 km.) above Florence, Ala. At this point there are now two channels separated by Jackson Island, and in one of the channels is the lock of the Muscle Shoals Canal. As a part of the new installation there will be locks providing for navigation past the dam, with a total lift of 90 ft. (27 m.) above level of proposed lower pool. The completion of the dam will also facilitate navigation above this point, for it is



THREE-PASSAGEWAY INTAKE TO WHEEL CHAMBER IS ONE RATHER UNUSUAL ARRANGEMENT

estimated that the storage will extend in sufficient depth for 17 miles (31 km.) above the dam to provide for navigation by typical canal barges requiring approximately 6 ft. (1.8 m.) of depth. The level above the dam will be closely controlled, only a very few feet of variation throughout the entire year being expected because of the ample provision of spillway gates along two-thirds of the length of the structure.

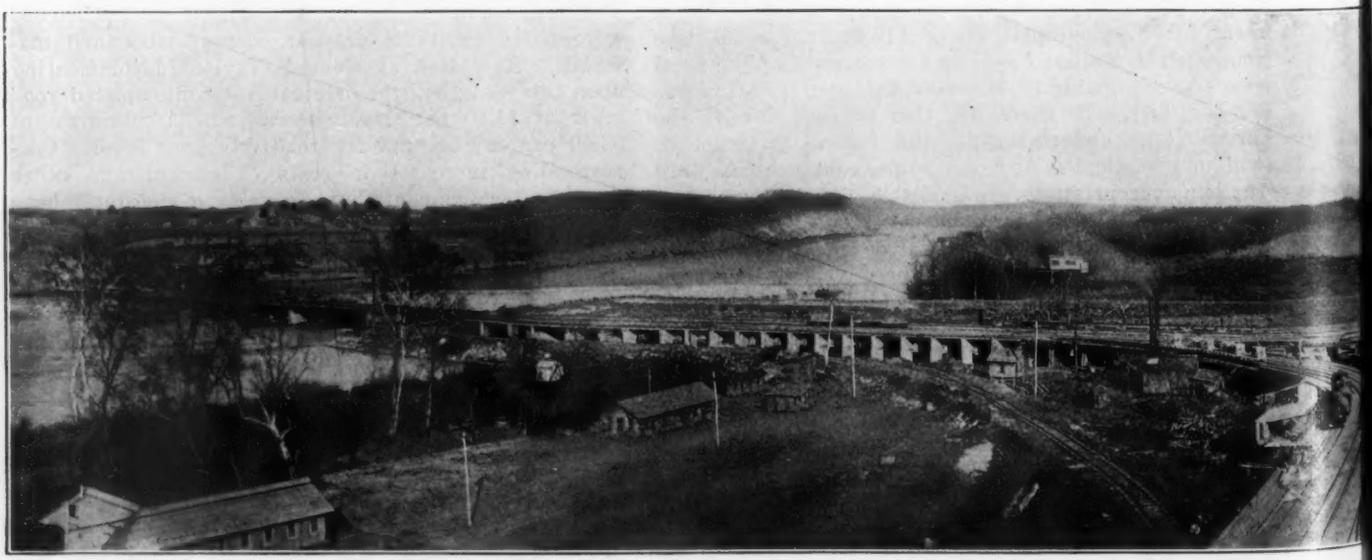
The principal characteristics of the dam proper will be seen from the illustration at top of page 589 of this article. The fixed dam is surmounted with movable crest gates 15 ft. (4.5 m.) high. It is estimated that these gate structures are ample to care even for the extreme flood stage, which is variously estimated at from 500,000 sec.-ft. to 700,000 sec.-ft. (14,150 cu.m. to 19,800 cu.m. per second), without excessive variation in forebay water level.

PRESENT STATUS OF PROJECT

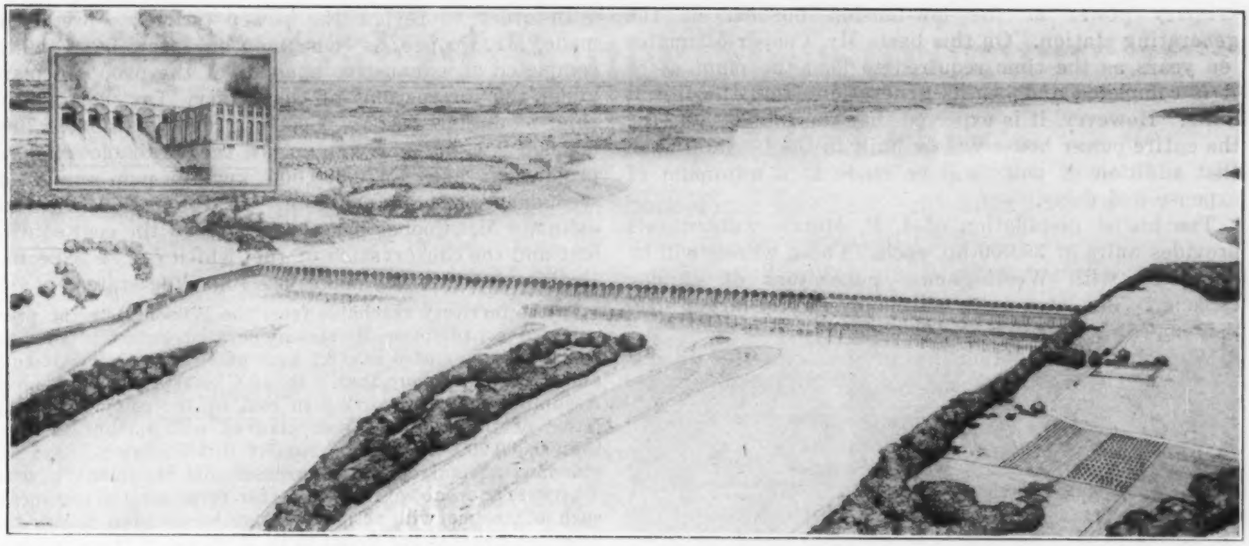
As indicated above, there still remains to be poured approximately 1,000,000 cu.yd. (764,560 cu.m.) of concrete work, and progress is being made at the rate of nearly 40,000 cu.yd. (30,580 cu.m.) per month. At this rate only twenty-five months would be required for completion. Whether this rate can be maintained will depend as much upon the availability of funds as upon the vagaries of the river or of the weather. Of the $17,000,000 thus far made available and other very limited sums which arise from miscellaneous allotment to the work, there remained only about $9,500,000 available at the end of the last fiscal year—July 1, 1920. This sum has been expended at the rate of nearly $1,000,000 per month thus far during the current year, but this large expenditure is in part the result of having placed a number of big contracts. It is estimated, therefore, that there are sufficient funds to extend into June of the present year.

The estimates made a year ago were that not more than $10,000,000 could be expended efficiently during the next fiscal year, and this sum was therefore requested of Congress. The House of Representatives considered this request in the sundry civil appropriation bill, but after debate on the floor of the House the item was dropped out. The Senate committee on appropriations also gave favorable consideration to the item, recommending it to the Senate, by which body it was adopted. However, the House of Representatives after vigorous effort on the part of those who opposed the bill still declined to agree to the item and in the closing days of the session the Senate finally agreed to abandon this appropriation for the present Congress.

As the money requested for continuance of the work next year was not granted, it may be essential to stop the present activity even before June, in order to conserve some funds for care of the project durnig the summer or until such time as additional funds are appropriated. This is deemed by all interested persons to be a most unfortunate possibility, for the organization is now built up for rapid work and more than 4,400 men have been working during recent months. To allow this going organization to be disbanded and to require that the work be held in abeyance for a year would seriously increase its cost. It has been estimated variously that the losses from suspension of the work one single year would certainly be between $4,000,000 and $10,000,000. The loss in interest upon the investments already made in the project and in the nitrate plant which is intimately associated with the entire development alone would amount to millions. One estimate made by the economists shows that the loss from a single year's suspension of activities may be



GOVERNMENT PROJECT ON TENNESSEE RIVER AT MUSCLE SHOALS, WHICH IS NOW 30 PER CENT COMPLETE—



PLANS CALL FOR AN ULTIMATE RATING OF 550,000 HP., MADE UP OF EIGHTEEN 30,000-HP. UNITS. THE DAM AND POWER HOUSE STRUCTURE IS 4,200 FT. LONG AND THE DEVELOPED HEAD WILL BE ABOUT 95 FT.

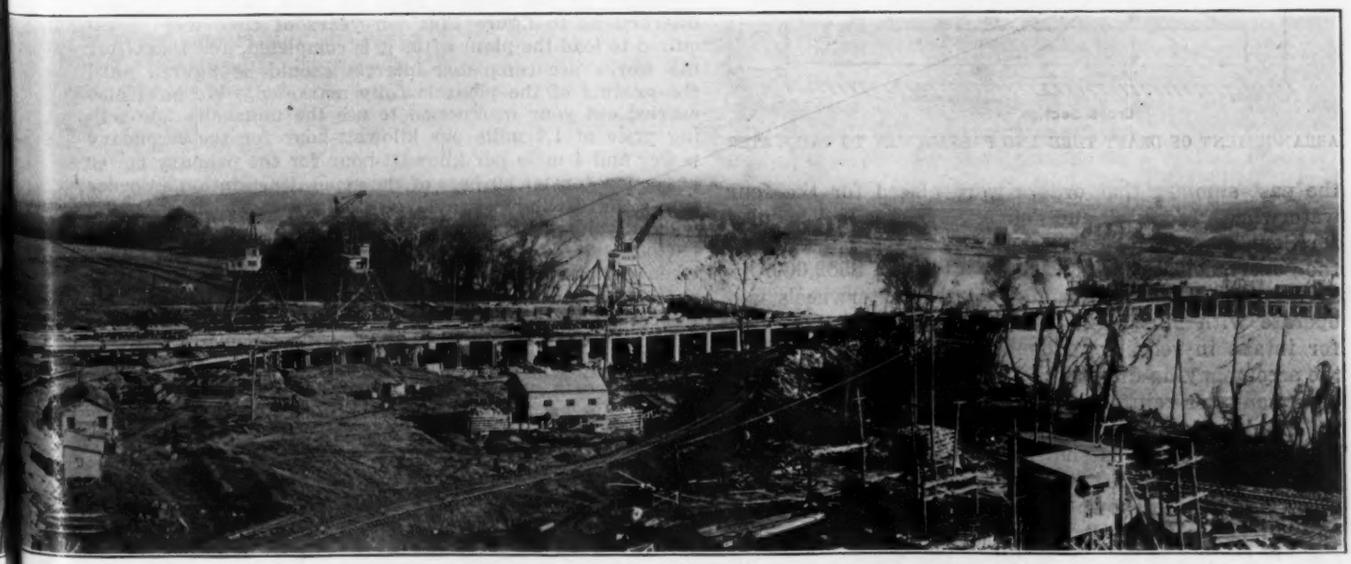
greater than the required appropriation for continuance of the work. However, even this argument did not suffice to get approval for continuance of the work.

In connection with the estimates of cost for interruption of construction work, the figures which have been furnished to the Engineer Corps by Hugh L. Cooper, the consulting engineer of the project, are particularly pertinent. Mr. Cooper states his opinion upon this matter as follows:

The second question, as to the cost of closing down the work at this time, is difficult to answer. It is not conceivable that the government would withdraw from this project entirely, in view of the more than $12,000,000 already invested and the showing in the foregoing paragraphs. In order to estimate the cost of a shutdown it would be necessary to have a basis as to the date when work would be resumed, so that the loss in interest might be computed. If the work should shut down at this time to be resumed in three years, I am of the opinion that the combined losses to the government would be around $4,000,000, and without any compensation therefor unless the government might claim there was a compensation to be expected in waiting three years for a lower interest rate than can be obtained at this time. This amount of saving would be very small as compared to the $4,000,000 loss. The $4,000,000 would represent a loss of interest during three years on $12,000,000, and on the construction side the loss of all the cofferdams which are now in place, the loss of the construction bridge, the removal and re-erection of a large amount of construction derricks, tracks, concrete mixers and rock crushers and other construction equipment. The job would also have to suffer the losses incident to the breaking up of the construction organization, which has been assembled at necessarily large expense, and I feel very certain that collectively the above losses would be a minimum of $4,000,000 and might easily amount to $4,500,000.

POWER HOUSE PLANNED FOR EIGHTEEN UNITS

The power house proposed is to consist of eighteen units. However, only four of these units are to be installed at once, and it is probable that only these will be needed within the first year or two of operation. It is realized that it will take several years to develop the market for the entire project, even assuming a very low selling price of 1.2 mills per kilowatt-hour for the secondary power and 4 mills per kilowatt-hour for the

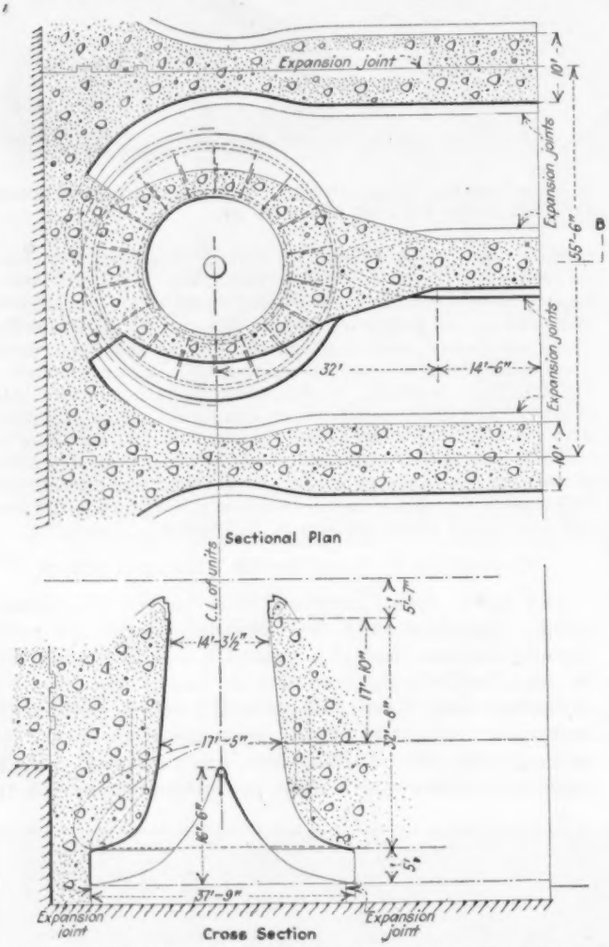


VIEW LOOKING UP STREAM, POWER HOUSE SITE ON THE RIGHT AND LOCKS AT EXTREME LEFT

primary power at the low-tension busbars of the generating station. On this basis Mr. Cooper estimates ten years as the time required to load the plant after it is completed and begins generation from the initial units. However, it is expected that the foundations for the entire power house will be built in the beginning, so that addition of units will be made at a minimum of expense and delay.

The initial installation of I. P. Morris waterwheels provides units of 30,000 hp. each. These wheels will be connected with Westinghouse generators of similar capacity. The later units will be of slightly larger size, it is hoped.

Work on the foundations has progressed so far during



ARRANGEMENT OF DRAFT TUBE AND PASSAGEWAY TO TAILWATER

the past summer that orders were placed for the four waterwheels required, and delivery of these is scheduled for Sept. 15 next. These units, it is estimated, will cost the government $129,500 each, or a total of $589,600.

According to the plans adopted the waterwheels will operate with 92 ft. (28 m.) head. The general plan for intake in relation to generator position is seen in the accompanying diagram, which also indicates the type of rectangular reinforcement which is used in inclosing the intake passages. The waterwheel foundation both in plan and section is shown in an accompanying illustration, and the draft tube and discharge passages to tailwater are also shown in plan and section. These are as planned by the I. P. Morris department of William Cramp & Sons, who are building the waterwheels for the initial installation.

In order to review the power estimates previously made, Mr. Cooper, as consulting engineer, has recently completed an exhaustive analysis of the proposed plans under the instructions of Gen. Harry Taylor, assistant chief of engineers. Mr. Cooper's report estimates 700,000,000 kw.-hr. per annum as the available primary production and 1,470,000,000 kw.-hr. per annum as secondary power production. In connection with his estimate Mr. Cooper has also estimated the coal equivalent and the conservation of fuel which can be expected. In this connection he makes the following statement:

In the territory reachable from the Wilson Dam the present coal consumption in steam-operated industries will be found in excess of 6 lb. (2.7 kg.) of coal per kilowatt-hour and is probably more than 8 lb. (3.6 kg.) per kilowatt-hour. Assuming 6 lb., the saving in coal by the complete installation of the works as now planned will amount to more than 6,500,000 tons per annum if this energy is used for standard normal domestic purposes. If the plant is used otherwise than above indicated (for fertilizer for instance), such other use will not, of course, be adopted unless the resulting benefits are found to be in excess of those incident to the conservation of 6,500,000 tons of coal per annum, and therefore you should be safe in submitting the coal-saving quantities as a basis for Congressional determination of future action.

General Taylor has summarized the power possibilities of the project in a somewhat different way in his testimony before the committees of Congress. He states that the extreme low flow of the river for ten years shows not less than 85,000 hp. (64,000 kw.) at any time recorded. But in only six of the nineteen recorded years did the low river discharge fall below the equivalent of 100,000 hp. In fact, it was below this figure only 1.3 per cent of the total time. Furthermore, it is believed that with the storage available at least 500,000 hp. additional can be generated for eight months of the year. This secondary horsepower, it was proposed by former Secretary of War Baker, should be applied to industrial operations, as the nitrate plant.

COST OF POWER PRODUCTION

In connection with his estimate of power capacity Mr. Cooper has also been asked to comment upon power costs. He reports on several phases of this question in a communication dated Nov. 27 as follows:

In determining the amount of power that should be developed at the Wilson Dam we have carried out your instructions to figure that ten years of time will be required to load the plant after it is completed, and that after the works are completed interest should be figured until the product of the plant is fully marketed. We have also carried out your instruction to use the unusually low selling price of 1.2 mills per kilowatt-hour for the secondary power and 4 mills per kilowatt-hour for the primary power at the low-tension busbars of the generating station, in order that Congress may always be certain that the final results will fully justify the money to be here invested.

Under your instructions we have figured that the plant when completed must earn 5 per cent for interest and 5 per cent for depreciation and operation, or 10 per cent of the cost of the power end of the enterprise. Both of these assumptions are conservative. The kilowatt-hours in paragraph 2 multiplied by the selling prices in paragraph 4 will produce a gross annual income of $4,554,000, which is 10 per cent of a cost price of $45,540,000. The best estimate that can be made at this time of the total cost of the project, including the two lift locks and all of the navigation facilities, is around $50,000,000, and thus leaves about $4,500,000 as amount applicable to the navigation account.

All of the above quantities are accurate and are not to be considered as assumptions or approximations. The values for the secondary and primary kilowatt-hours are about 50 per cent of pre-war steam costs in this territory.

New Method of Water Measurement in 37,500-Hp. Turbine Tests

Scheme Has Advantages of Accuracy, Short Time for Test and Inexpensive Apparatus—Discharge Is Measured by Pressure Developed in Penstock When Turbine Gates Are Closed—Method Has Been Applied at Niagara Falls

ON ACCOUNT of the restrictions placed by law upon the diversion of water from the Niagara River for power purposes, the measurement of the quantity of water used in the various power plants is a matter of extreme importance. One per cent of the present allowable diversion on the American side is sufficient to develop 4,000 hp. The installation of three new units at station No. 3 extension of the Niagara Falls Power Company, each capable of generating about 40,000 hp., made it necessary to determine accurately the efficiencies of the waterwheels. In carrying out these tests new inventions now known as the Gibson Method and Apparatus* for measuring the flow of water in penstocks have been applied after extensive laboratory experiments had been carried out to determine the accuracy of the method. The turbine discharge is measured by utilizing a record which is made of the changes of pressure that occur in the penstock when the turbine gates are gradually closed.

One of the most important reasons for the use of this new test method was that tests could be carried out without serious or prolonged interruption of the supply of power from the unit being tested. It requires a two-minute shutdown for each measurement, and measurements may be repeated about once every ten or fifteen minutes. A complete set of measurements at each tenth of gate opening from half to full gate may be made in less than two hours, and during that time the unit would be out of commercial service only about fifteen minutes.

ADVANTAGES OF METHOD ARE SUMMARIZED

The advantages of the new method of measurement may be summarized as follows:

1. Remarkable accuracy in the determinations of the velocity of flow, because small changes of velocity result in comparatively large changes in the pressure to be recorded.

*Patents applied for.

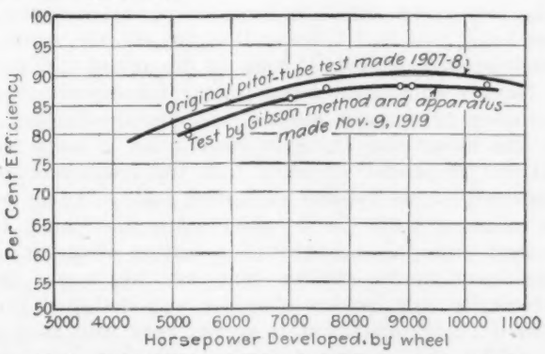


FIG. 1—EFFICIENCY CURVE OF OLDER UNIT CHECKED BY GIBSON METHOD (LOWER CURVE)

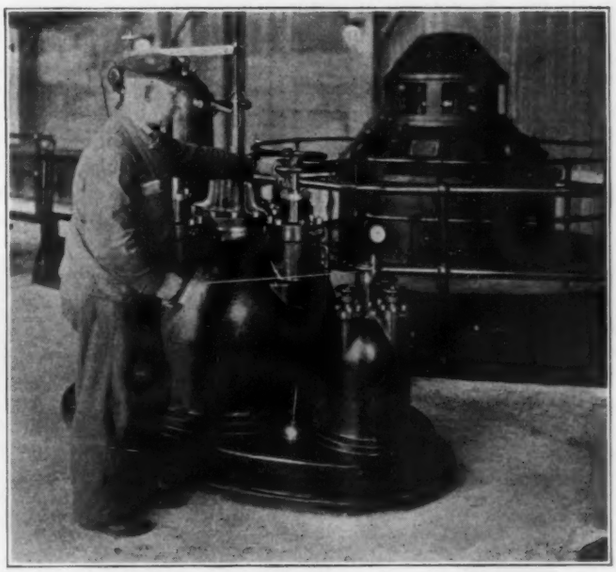


FIG. 2—STARTING THE GOVERNOR ACTION THAT CLOSES TURBINE GATES

2. Determinations of velocity may be made without serious or prolonged interruption of the commercial supply of power from the unit being tested.

3. Each determination of the velocity of flow may be made quickly in one operation. Tedious methods involving tabulation of observed results are avoided.

4. The process is essentially simple and inexpensive. Special appurtenances in the pipe line are not required.

No attempt is made in this article to describe the apparatus in detail or to give the mathematical proof of the method. This matter will be reserved for a future paper.

According to the terms of the treaty between the United States and Great Britain, each country is permitted to divert for power purposes a certain quantity of water from the Niagara River. In the United States this quantity is 20,000 sec.-ft. (560 cu.m. per second) and the company's allotment is 19,500 sec.-ft. (550 cu.m. per second). The terms of this treaty are being rigorously observed. To determine the relation between power and discharge of a unit it was necessary, therefore, to measure the quantity of water that was used and incidentally to determine the efficiency of the turbine.

When the three new 37,500-hp. turbines of the Niagara Falls Power Company were installed and ready for operation the company was then in a position to use all the water to which it was entitled and the regulating authorities fixed the efficiencies of the new units at a point which it was believed would not be greater than the actual efficiencies. Possibly the efficiency was

fixed low enough to make it worth while for the company to go to the expense of proving the exact efficiency. In any event the results were not disappointing, because after making the official tests, which received the approval of the government engineers, the allowable output from these three units when charged with the same quantity of water as formerly was increased nearly 5,000 hp.

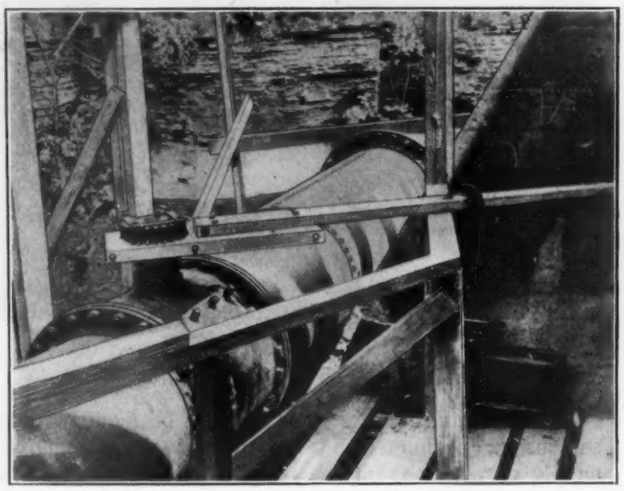
The new method was invented and developed by Mr. Gibson as the outcome of studies of the changes of pressure in penstocks caused by the gradual closing of turbine gates. It is possible to determine the mean velocity of a column of water in a penstock by recording the changes of pressure at a point in the pipe line when the flow of water is gradually brought to rest by closing the valve or the turbine gates. The mean change of pressure recorded is a precise measure of the velocity destroyed. Practically, it is not always possible to stop the flow entirely because leakage usually occurs through the turbine gates, and in such cases the velocity determined is the difference between the initial and final velocities. The remainder, however, is readily determined.

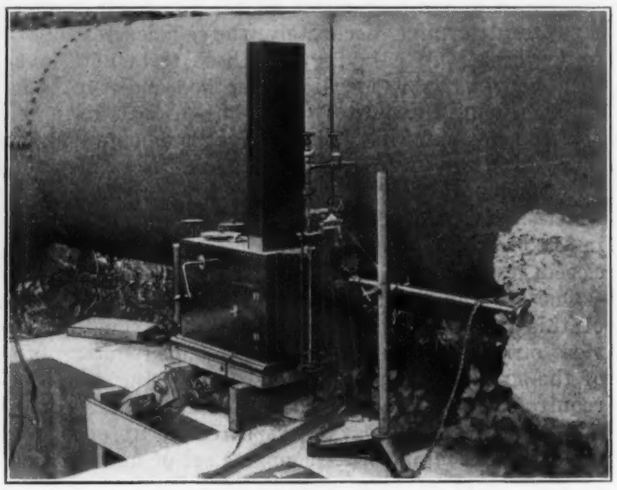
The apparatus comprises a new combination of simple elemental parts in which the pressure element is a U-tube containing mercury, the motion of which can be made to correspond in any desired ratio to the change of pressure in the penstock. The apparatus provides illumination and records photographically, to exact full scale, the motion of the top surface of the mercury in the tube, combining in the record the oscillations of a second's pendulum. The resulting diagram shows to exact scale a complete record of pressure changes and time.

The first experimental equipment comprised a headwater tank feeding a 3-in. (7.6-cm.) wrought-iron pipe 420 ft. (126 m.) long, near the lower end of which was placed a 3-in. globe valve. The flow through this pipe was made to discharge into a measuring tank, and by maintaining a constant level in the head tank and opening the globe valve varying distances, it was possible to produce a steady flow in the 3-in. pipe at various velocities up to 4 ft. (1.2 m.) per second. The results of experiments of this apparatus were remarkably satisfactory considering the nature of the equipment, and it was found that the variation of measurements by the new method from the volumetric measurements was seldom greater than one-half of 1 per cent.

CORNELL UNIVERSITY TESTS CHECK GIBSON METHOD

In order to obtain positive proof of the accuracy of the new method of measurement, however, arrangements were made to have a thorough test made at Cornell University by comparison with volumetric measurements at the laboratory at that university, where the equipment is adequate for such work. The results of these tests show that the average of all measurements made by the Gibson method agrees within less than 0.2 per cent with the average of all the volumetric measurements. The maximum variation of any one series is 0.8 per cent. A careful analysis of these results indicates that part of even the slight variations between the volumetric measurements and the measurements by the new method may be explained by a very slight unsteadiness of the flow, which is sufficient to account for some of the difference between the two measurements. It might be mentioned that the tests also proved that measurements can be made just as accurately when the conduit is made up of sections of various diameters, and that differential measurements can be made by using two sets of apparatus and the length of conduit lying between them.





FIGS. 3 AND 4—PROVISION FOR SHUTTING OFF WATER IN PENSTOCK AND GIBSON APPARATUS SET UP FOR TEST AT CORNELL UNIVERSITY

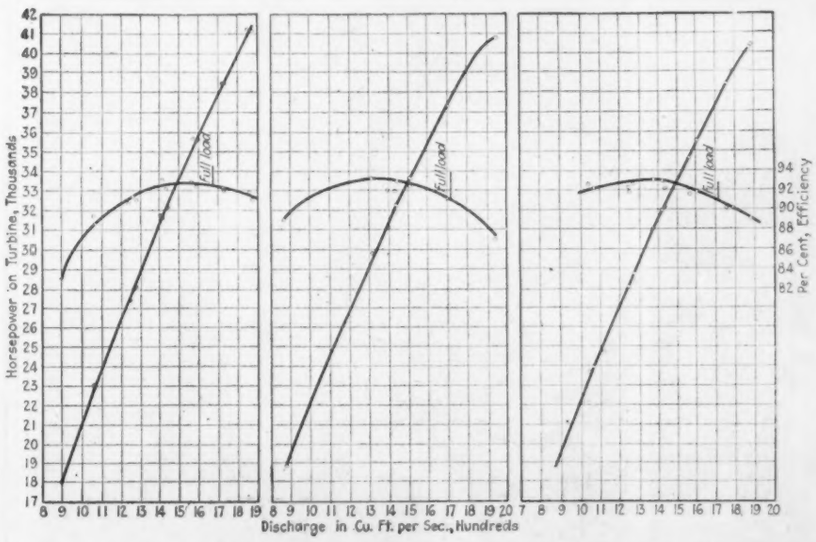
Fig. 1 shows the first efficiency curve of one of the Niagara Falls units obtained by this new method, and just above it the efficiency curve made by the Pitot tube methods some years previously on a similar unit. The two curves have the same characteristics, the new one being just a little lower than the old one, which was considered reasonable in view of the age of the unit.

Having thus established by careful experiments the accuracy of the new method, the official efficiency tests of the three new units in station No. 3 were undertaken. It should be noted that the lower end of the penstock tunnel is lined with steel plate and just before it connects with the Johnson valve the lining forms a steel pipe passing through a testing chamber which has been made at the rear of the power house. Originally this testing chamber was designed for the use of Pitot tubes, but it serves very well as a place in which the apparatus for recording the changes of pressure in the penstock may be set up.

The general procedure for the test by the new method was as follows:

1. The physical dimensions of the interior of the penstock were measured from field data and available drawings.

2. Prior to all the tests that were made on any one unit, a leakage test was made to determine the quantity of water that leaked out through the turbine gates when closed. This is necessary in the new method because only the flow actually shut off is measured, and whatever remains must be added to the total discharge.



FIGS. 5, 6 AND 7—POWER-DISCHARGE CURVES AND EFFICIENCY-DISCHARGE CURVES FOR THE THREE 37,500-HP. TURBINES NOS. 16, 17 AND 18

3. Having completed this preliminary work, the apparatus was attached to a ¼-in. (6.4-mm.) piezometer opening tapped into the wall of the penstock.

4. Headwater and tailwater float gages were placed in the forebay and tailrace for observing the elevation of headwater and tailwater during a test.

5. A system of electric signal bells was established, the control buttons being placed in the testing chamber near the operator of the apparatus. When ready the observer in the testing chamber could signal to the observers at forebay and tailrace and to the governor operator.

6. For observing the net head on the turbine a U-tube mercury manometer was set up with a connection to the penstock just at the entrance to the turbine casing. Two observers recorded the elevations of the surfaces of the liquid in the two legs of the U-tube. This gage was calibrated by reference to the total static head when the water was at rest.

7. The unit being tested was synchronized with other units in the plant and allowed to run on steady load with gates fixed for several minutes, and then it was shut down at a given signal by operating the hand-control pilot valve on the governor. A cord was wound around the stem of the valve and on a given signal the operator pulled the cord which spun the pilot valve wide open. The pressure fluid then flowed to the regulating cylinders which operate the gates, and they were closed just as fast as the fluid could flow through the connecting pipes into the regulating cylinders. The connecting pipes can be throttled to reduce the speed of closing if necessary. On other units the pilot valve is opened by means of a handwheel, but the effect is the same. The duration of closure was usually from about eight to eighteen seconds, depending upon the amount of gate opening.

Immediately preceding and during the closure of the gates and for a short time after the apparatus recorded the changes of pressure in the penstock, forming a diagram similar to that shown in Fig. 8. As the gates of the turbine closed the load on the generator was transferred automatically to the other units operating in synchronism with it, sufficient capacity having been left available for that purpose, and the unit under test being then driven as a motor at synchronous speed.

8. For two minutes prior to the shutdown the power output of the generator was determined by periodic readings of a calibrated indicating wattmeter attached to the generator leads through calibrated currents and potential transformers. The power output of the turbine was obtained by using the efficiency of the generator, which was determined by the company's electrical engineers.

9. Periodic readings of headwater and tailwater gages were also made for the two-minute period prior to the shutdown and for a short time thereafter.

After velocities had been calculated from the diagrams and discharges and effective heads computed the usual power-discharge and efficiency curves were prepared.

From the curves that were obtained for the three new units (Figs. 5, 6 and 7) there will be noted remarkable uniformity in the determination of the points along the power discharge curves, from which

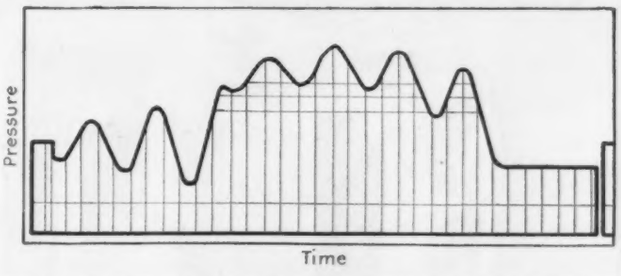


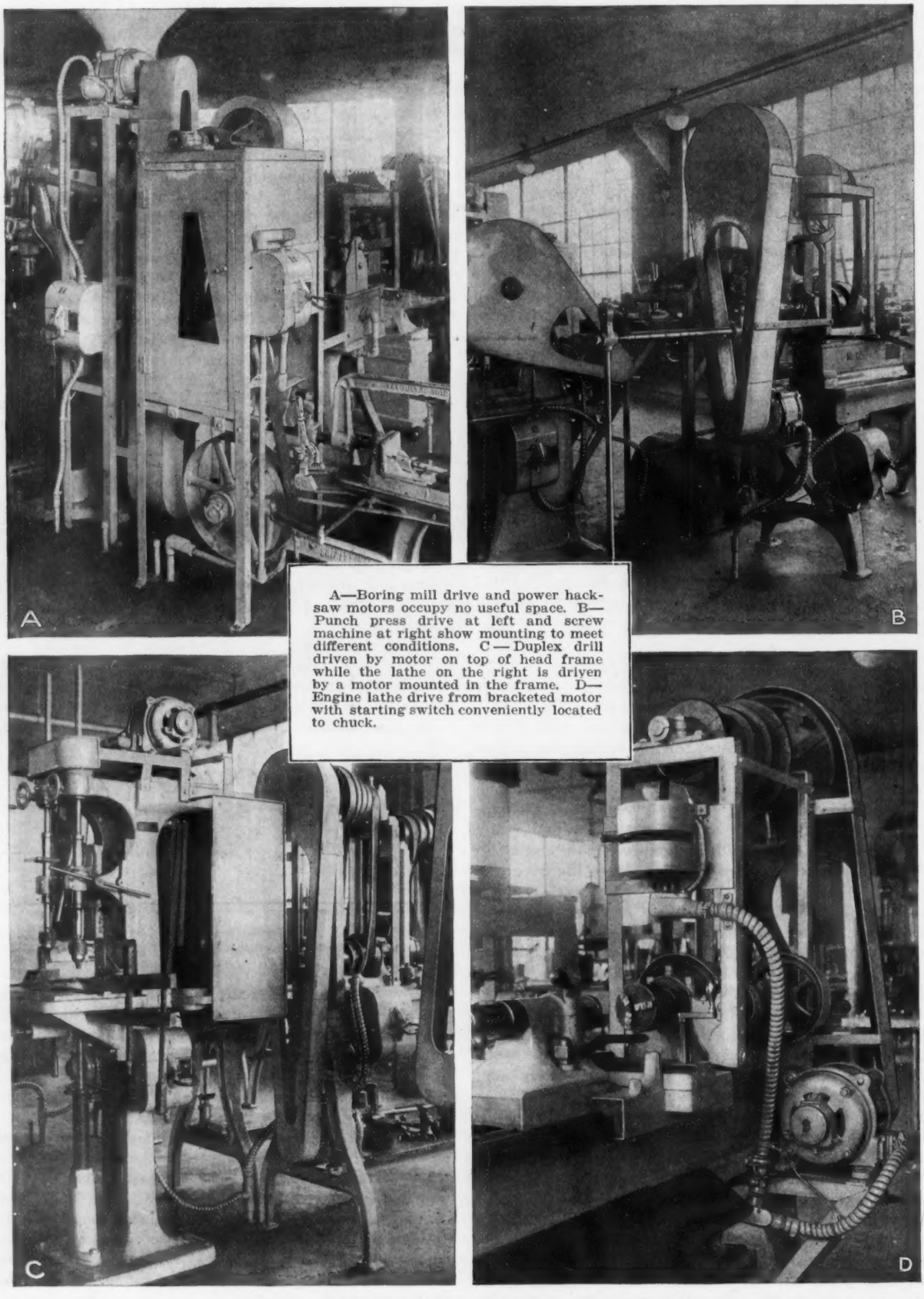
FIG. 8—SAMPLE OF PRESSURE CURVE OBTAINED FROM PENSTOCK DURING CLOSING OF GATE

it may be concluded that the errors of observation, or so-called variable errors, are extremely small. The absence of any inherent or consistent error was demonstrated by the tests that were made at Cornell University.

The theoretical reasoning to show how discharge data are derived from the pressure-time curves (such as Fig. 8) will be discussed by Mr. Gibson in the near future.

The foregoing was discussed more extensively by Norman R. Gibson, hydraulic engineer Niagara Falls Power Company, at a joint meeting of the Engineers' Club of Philadelphia and the Philadelphia sections of the American Society of Civil Engineers, American Institute of Electrical Engineers and American Society of Mechanical Engineers.

Fig. 1—Individual Drives Which Show Possibilities in Motor Location



A—Boring mill drive and power hack-saw motors occupy no useful space. B—Punch press drive at left and screw machine at right show mounting to meet different conditions. C—Duplex drill driven by motor on top of head frame while the lathe on the right is driven by a motor mounted in the frame. D—Engine lathe drive from bracketed motor with starting switch conveniently located to chuck.

Mounting Motors to Afford Convenience

A Study of Individual Drives Shows Methods of Mounting Motors to Increase Free Space in Shop—Starting-Switch Location Important—Installations Which Show Various Arrangements

By J. S. THOMAS
Superintendent Repair Shops Western Electric Company, Inc., Boston

IT IS well known that individual motor drives offer production departments a high range of flexibility in machine location; that these installations increase the free space in shops, help to secure the best lighting conditions and facilitate maximum output per tool. The variety of motor mountings useful in such work, however, is not always realized. The differing shapes of tools to be driven offer the electrical engineer a fascinating choice of methods of motor attachment, and even within a single shop one may find enough diversity of applications to justify considerable study. The accompanying illustrations show locally adapted individual motor drives at the repair shop of the Western Electric Company, Inc., 385 Summer Street, Boston, viewing these installations from the standpoint of convenient mounting.

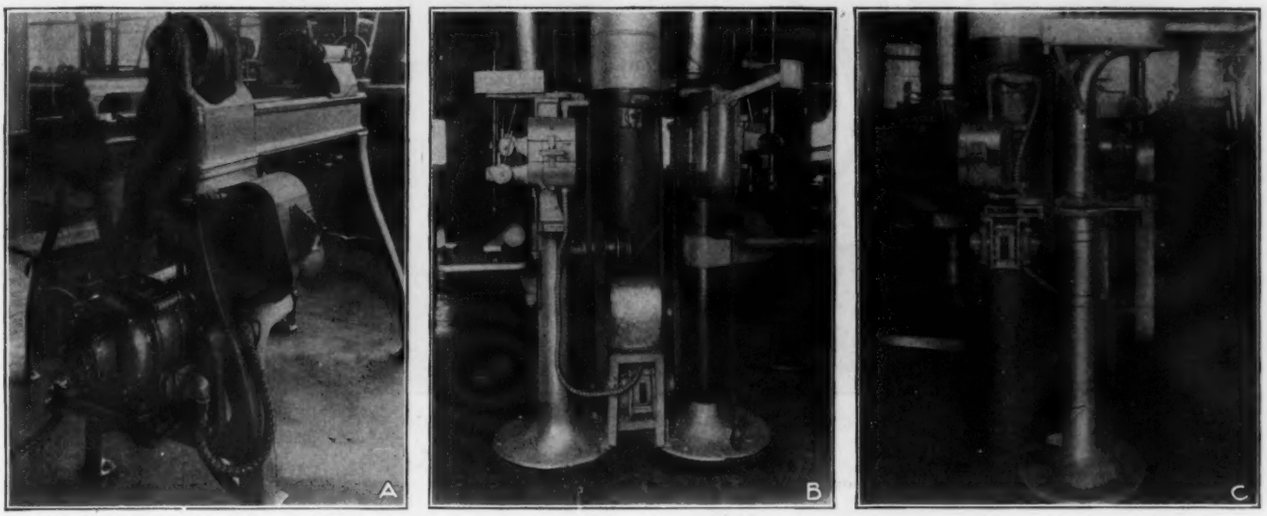


FIG. 2—CONVENIENTLY PLACED SWITCHES AID EFFICIENT OPERATION OF MACHINES

A—Accessibility of the starting switch is evident in this lathe drive. Belt adjustments are taken care of by mounting the motor on the hinged bracket. B—One motor is mounted above another in the case of these two drill presses. Switches are conveniently located. C—Underhung mounting of motor for a drill press, which offers a convenient arrangement for this type of machine.

Fig. 1-A illustrates two adjacent drives of compact arrangement. In this case a 1-hp. motor drives a boring mill from an angle-iron frame carried above the machine, the angles being 1½ in. x 1½ in. x $\frac{3}{16}$ in. (38 mm. x 38 mm. x 5 mm.) in section. The location of the motor behind and above the operating head of this machine economizes space and facilitates inspection and maintenance. The individual belt drive from the motor is guarded by a continuous housing of No. 20 galvanized sheet iron, notwithstanding its location between the boring mill and the hacksaw. The angle frame provides a convenient support for the motor-starting switch, and a short, direct run of armored flexible conductor feeds the motor through the switch. A 1-hp. motor also drives the hacksaw. In this case the motor is mounted on two short horizontal straps attached to an angle-iron frame which houses the major portion of the belting and pulley equipment required to obtain the speed reduction necessary for saw operation. The motor is completely within the frame and thus occupies space of no other value from the production standpoint. A short feed by rigid conduit was used in this case in view of the narrow clearance between the driving mechanism and the riser. The starting switch is within easy reach of the operator, and a doorway in the housing affords instant access to the motor. These two machines, like many others in the shop, are placed back to back in order to conserve aisle space. Three-phase 220-volt motors are generally used in machine driving in this shop, which is occupied chiefly with the repair of telephone exchange and substation apparatus, electrical appliance maintenance and miscellaneous work. All conduit is grounded to the machine frames.

A punch press driven by a 1-hp. motor and a screw machine partially driven by a 1-hp. motor are shown in Fig. 1-B. To secure the proper height in mounting the motor for the punch press the simple expedient of placing it on two 3-in. x 1½-in. x ¼-in. (76 mm. x 38 mm. x 6.4 mm.) channel-irons was adopted, these being bolted to a bracket formed of 1½ in. x 1½ in. x ¼ in. (38-mm. x 38-mm. x 6.4-mm.) angles set on the pedestal face away from the working front of the machine. The starting switch is also mounted on another side of the pedestal, close to the operator's position. The projected area below this motor is of little value from the production standpoint. Another compact bracket

mounting is shown at the end of the screw-machine frame, where the motor is placed on a 1¾-in. x ¼-in. (45-mm. x 6.4-mm.) strap iron carried by two 2-in. x ¼-in. (51-mm. x 6.4-mm.) straps at right angles, the latter being attached to a bracket made up of 1½-in. x 1½-in. x ⅛-in. (38-mm. x 38-mm. x 4.7-mm.) angles. Short runs of flexible conduit from the floor outlet to a starting box on the front pedestal of the machine and thence to the motor are convenient and economical of material.

A duplex drill and a lathe motor drive are shown in Fig. 1-C. Here the framing necessary to support the drill shaft bearings and connected belting and countershafting provides ample space for mounting a 1-hp. motor at the top of the machine, away from operator and passers-by and still within easy inspection reach. The motor is bolted to ½-in. x 1½-in. (13-mm. x 38-mm.) iron straps attached in the same way to U-shaped straps of the foregoing size that are bolted into the drill head framing. As in other individually driven cases in this main belt drive. The motor is mounted on 1¾-in. x ¼-in. (44-mm. x 6.4-mm.) iron straps bolted to 1½-in. x 1½-in. x ¼-in. (38-mm. x 38-mm. x 6.4-mm.) angle brackets. In this case by mounting the starting switch on the side of the framing supporting the main driving pulleys toward the operator a firm and immovable support was obtained, leaving the apron of the lathe free to travel back and forth at the front of the machine. This location of the starting switch insures close relationship between the progress of cutting operations at the tool rest and the immediate control of the motor starting and stopping. The motor does not project into a main aisle.

The speed lathe shown in Fig. 2-A is driven by a ¾-hp. motor mounted on a bracket that can be swung a short distance about a horizontal axis in order to facilitate changing the belt to obtain speed variations. Here the machine driven is relatively small and the low mounting of the motor stabilized the construction. Only a few speed changes are necessary. The motor is

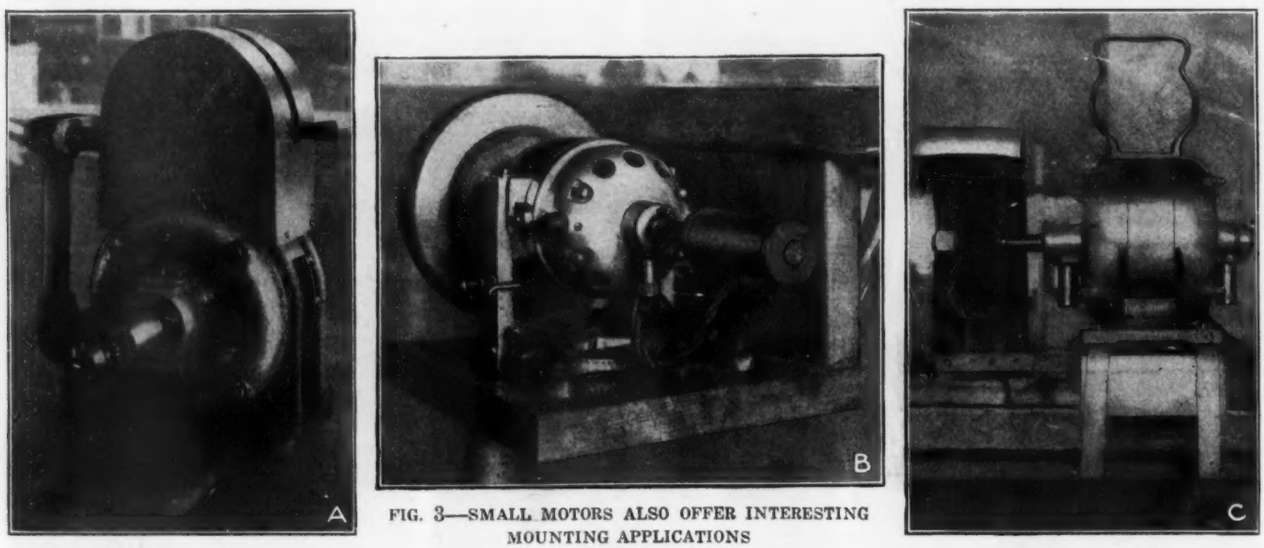


FIG. 3—SMALL MOTORS ALSO OFFER INTERESTING MOUNTING APPLICATIONS

A—Reversing switch mounted on top of motor frame saves wiring and speeds up operation of outfit for screw and nut removal. B—Convenient mounting pays even with a small motor for coil winding. C—A motor-driven polisher fitted with "U" brackets for easy mounting on bench. The arrangement permits the easy removal of the polisher to any bench location.

shop, an effort was made here to place the starting switch close enough to the working plane to render it unnecessary for the operator to step aside in order to start or stop the motor, and the drill pedestal offered the most desirable location. The lathe, at the right, illustrates maximum compactness in motor driving. The ¾-hp. motor used is installed within the frame and so close to the end pedestal that it utilizes the open space in this framing for shaft and pulley connection, leaving ample space on the horizontal shelf at the right for the storage of extra lathe parts. The long belt connection employed here between the motor pulley and the pulleys at the top of the machine affords a flexible drive, easily protected by the guard shown and convenient for speed modifications. The motor is carried on 1½-in. x 1½-in. x ⅛-in. (38-mm. x 38-mm. x 4.7-mm.) angles.

Fig. 1-D shows the driving of an engine lathe by a 1-hp. motor mounted on a bracket projecting from the lower portion of the frame. In this case fairly heavy pulleys were required, and these are mounted on a vertical frame carried up from the working center line as shown. The back gears are well cleared by the bolted to 1½-in. x ¾-in. (38-mm. x 19-mm.) straps, which in turn are bolted to the casting forming the movable bedplate. A pedal is provided to raise the motor and pulley so that the belt can be loosened readily in making a speed change. The light frame of the lathe affords a convenient base for the starting switch.

Economy of material is illustrated in the "two-story" motor mounting shown in Fig. 2-B. Here two adjacent drill presses are backed up as close as possible to a column of the building; the bases are utilized to support the feet of an angle-iron framing for each of two 1-hp. motors set one above the other and connected by short belt drives to the drill-press pulleys. The angles are of 1½-in. x 1½-in. x ⅛-in. (38-mm. x 38-mm. x 4.7-mm.) section, and one motor is carried within the framing that supports the other. From conduit within the column a feed line is run to the starting switch of each drill press, with armored conduit connection to each motor as indicated. Maximum compactness is here associated with unusual convenience of motor access and facility of switch handling. The upper motor is carried on 1½-in. x ¼-in. (38-mm. x 6.4-mm.) straps.

A drill press capable of handling work about 12 in. (30 cm.) in diameter is shown in Fig. 2-C. This machine was originally designed for belt driving off a pulley carried at the left of the main column. It was conveniently equipped with a ½-hp. motor drive by bolting two ⅜-in. x ⅞-in. (9.5-mm. x 22-mm.) iron straps to a bearing housing extension as shown, the motor feet being bolted to the straps for an underhung suspension that provides a flexible belt run to the quarter-turn pulley shown at the top and thence to the main-shaft pulley within and at the right end of the housing.

Location of the drill press close to the column enabled the feed to the starting switch and motor to be short and economical, the starting switch for the drill being clamped to the vertical standard as indicated just below the working plane.

Saving in space by mounting a starting and reversing switch on top of a motor frame is shown in Fig. 3-A. Here a ½-hp. motor running 1,800 r.p.m. on 220-volt, three-phase supply is mounted on an iron base as shown, the motor being equipped with an adjustable-jaw extension piece on its shaft for the rapid removal of nuts. Another fitting resembling a screwdriver enables screws to be quickly removed from work. The switch on top of the motor is connected to reverse one phase when thrown to the right or left, and is provided with a 6-in. x 7-in. x 4½-in. (15-cm. x 17.5-cm. x 11-cm.) metal guard as shown. A short run of rigid conduit carries the necessary conductors for the motor supply.

The mounting of a motor of the sewing-machine type used to wind coils of wire at a bench is shown in Fig. 3-B. A simple right-angled bracket of wood ¾ in. (2 cm.) thick by about 7 in. (17.5 cm.) square forms the base, and an upright slab of the same thickness is attached to the bench by ordinary cast-iron brackets. The motor frame and brackets are grounded, and the motor is operated at 110 volts, single-phase. It is screwed into the slab and is controlled by a floor pedal.

A portable motor mounting that gives excellent service is shown in Fig. 3-C. The motor drives a polishing wheel and is provided with two ¾-in. x ⅝-in. (19-mm. x 8-mm.) U-strap brackets which can be fastened at the edge of a bench by setscrews for quick attachment at different locations. A 2-in. x 5-in. (5-cm. x 12.5-cm.) wooden base is provided for the motor, and this is surfaced by a sheet-tin grounding plate as indicated, a guard to prevent the throwing of metal grindings from the polisher being held in place behind the wheel by iron straps. A handle at the top of the motor enables the entire device to be carried without difficulty.

WE HAVE *had to sail on an uncharted sea, impressed with the duty of ultimately making that sea so well known and safe that the public, the public service corporations and the commission might voyage together, each without fear or distrust of the other, each certain that no carrying craft was financially rotten, each confident that no submarine of special privilege, secret rebate or unlawful practice could or would attempt suddenly to destroy the property of the honest mariner, each convinced that all the others are in a sense partners who are entitled to full information, fair treatment and a just share in whatever prosperity is being passed around.*—B. F. CLEAVES, chairman Maine Public Utilities Commission.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Maintenance of Live Conductors

To the Editor of the ELECTRICAL WORLD:

SIR: The maintenance of live conductors and the use of devices for this purpose have received much attention and study of late. If proper care were given to the method of using these devices by linemen, the expense of making high-tension repairs might be reduced. However, such a method of making repairs to high-tension lines must, in my opinion, be more or less dangerous even at the best, and where the system is used on lines carrying several circuits it appears that there are many chances for accidents.

The great trouble with the maintenance of live conductors is that the men who carry on such work are inclined to become careless after some experience, and just when they become careless is when an accident is likely to occur. The same observation might apply to the use of dynamite. It is a fact that miners and other craftsmen who handle dynamite become hardened to the danger and are therefore more or less careless. They come to the conclusion that there is no danger and do not take the necessary precautions. The result is an accident. More study should be given to the subject of maintaining conductors while alive, to the end that the greatest economy in operation may be achieved.

L. J. MOORE, Electrical Engineer.
San Joaquin Light & Power Corporation,
Fresno, Cal.

Actual Versus Reproduction Cost in Public Utility Appraisals

To the Editor of the ELECTRICAL WORLD:

SIR: It is with much interest that I have read the editorial on "Danger of Valuations at Present-Day Figures" in your issue of Aug. 21, 1920, also the comments by Harold Almert in the issue of Dec. 4, 1920, and by C. Wellington Koiner in the issue of Jan. 29, 1921.

The proper basis of pricing for valuing utility property for rate-making purposes has been one of the most perplexing problems that have arisen from the war conditions. Yet the solution lies in finding a logical basis that can be followed consistently through varying changes of market prices which will at all times insure fair treatment to both the utility and the public.

If a utility manager has long vision, he will not desire to see a sudden great inflation in the physical valuation of the property under his control any more than he would wish to see a sudden deflation in this value. If one comes, so must the other be expected in due course of time. The manager who insists on a valuation based on the abnormal high prices that have prevailed recently is not looking far into the future. He may have been spending a great deal of money for plant and equipment at abnormal prices for which he should receive con-

sideration at a later period when costs have reached a lower level. It will not serve him at a later period to make claims that he is entitled to consideration for high costs because expansion of business forced him to make expenditures whether he would or not. When he asks for present-day prices for property installed at lower costs he is adopting a principle and must abide by it when future conditions reverse the order of things.

Public utilities are entitled to remuneration in some form for all expenditures wisely made for the public service, and when lower prices shall have become prevalent the management should be able to face the public or commission, as the case may be, with a record that entitles it consistently to ask for fair consideration of the high costs of property necessarily installed during the period when prices were abnormally high.

No doubt the cost of reproducing the property at a figure which reflects present prices is valuable information to have and should be given consideration by the public or by a rate-regulating body, but for the utility management to insist upon present-day prices as repre senting the true value of the property is a mistake which is likely later to have serious consequences.

It is true that it is not always possible to obtain from a company's books the actual cost of the property, but it is not necessary that this should be done. With data relating to costs during past years, which are a part of the stock of many engineers and of regulating bodies, it is possible to approximate very closely the actual cost, or an estimate of the cost of reproducing the property at costs prevalent prior to 1916 can readily be made.

One method of arriving at a fair estimate of the value of the physical property is known as the "split inventory" method. In using this method all property installed since the abnormal rise in prices began is inventoried separately and actual costs applied. The actual costs of property constructed during the last few years can usually be obtained from records, or if not can be readily estimated. All property which was in service before the abnormal prices prevailed is then listed and valued either at estimated cost or on the basis of prices prevailing for a period of years ending with the beginning of abnormal prices.

During the present stringency the concern of the utility operator is not so much with a return upon the value of the property as with operating costs. The latter are handled direct by regulating bodies and are in general of much more importance to the manager than the former. Considered from the point of view of its influence upon rates, one dollar of operating expense is eight or nine times as important as one dollar of property value, though the latter must not be neglected.

Just at this time the cost of money is high and utilities have more or less trouble financing new construction or refinancing old issues. It does not appear, however, that the proper method of obtaining relief is by means of placing high estimates of value on property which actually cost a normal amount. If prices continue high for many years so that a new permanent level is actually reached, then consideration should probably be given to that fact, but we have not yet arrived at that stage. Prices may become very low—in fact, some commodities used by utilities can now be purchased at prices practically equivalent to those prevalent before the war—and it is important to be in such a position that absolutely fair dealing can consistently be demanded should conditions reverse.

It would seem that the proper relief for high cost of money is to allow a rate of return high enough to correspond to the increase. This is the logical solution and recognizes an actual condition which is readily demonstrated. To ask for a value of $200 on property that cost $100 simply because it costs more to operate it or because interest rates are high is not logical. It is true that when this property has become worn out it may require more money to replace it, but when that additional investment is made, then allowance of a fair return on the added capital can be made and the utility need not suffer.

C. M. LARSEN,
Engineer Railroad Commission of Wisconsin.
Madison, Wis.

Development in Cable Research

To the Editor of the ELECTRICAL WORLD:

SIR: I agree most heartily with the editorial in the issue of Feb. 26 discussing the remarkable development in cable research both in this country and abroad. It seems to me that reference to some of the high lights of this development deserve a place in your columns.

R. W. Atkinson *(Journal A. I. E. E.*, September, 1920) gives valuable data on the heat path, especially that within the cable, and gives tables showing how the current-carrying capacity of all types of paper and cambric cable may be computed if the sheath temperature is given. This is the most definite statement on the thermal properties of cable insulation that I have seen. Messrs. Davis and Simons *(Journal A. I. E. E.*, January, 1921) discuss maximum electric stresses and their location in various types of cable. They emphasize the low value of the maximum stress now considered permissible in its relation to the dielectric strength of the insulation and urge an increase in the maximum permissible stress to 25 kv. per centimeter, presenting data. Of especial interest are computations of the maximum voltages of cables of standard diameters and the prediction that shortly, with greater uniformity of insulation and consequent increased permissible stresses, operating voltages up to 50,000 will be reached. Information on temperatures reached for different soil conditions and manners of laying is given in a report by the British Electrical and Allied Industries Research Association, briefly outlined in the *Electrician* (London) for Dec. 24, 1920. The relatively low temperature rise of cables buried directly in the soil or embedded in bitumen are very striking. The influence of depth below surface shows 7½ per cent less current possible at 4 ft. (1.2 m.) than at 1 ft. (0.3 m.) depth.

The influence of load factor on cable temperature is strikingly shown by the observations of Philip Torchio in the February number of the *Journal A. I. E. E.* He points out the inconsistency of the standardization rules for low-voltage cables. He demands higher permissible temperatures for low-voltage cables and as regulated by load factor, principally because they have the same class of insulation as machines, are never continuously loaded as are machines, and consequently should be allowed at least equal temperatures. He reports runs of cables at high temperatures; for example, over 150 deg. for 169 hours without damage. On the other hand, in the same number of the *Journal A. I. E. E.*, W. A. Del Mar opposes the increase on the ground of resulting weakening of the mechanical properties of the paper.

J. B. WHITEHEAD,
Professor of Electrical Engineering.
Johns Hopkins University,
Baltimore, Md.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Lowering a Section of Penstock Into Place

A PLAN adopted for handling the heavy sections of penstock line for the new Kerckhoff power house of the San Joaquin Light & Power Corporation (see ELECTRICAL WORLD for Feb. 26, page 471) is shown in the accompanying photograph. This section of penstock

EIGHT-TON SECTION OF PENSTOCK LOWERED 1,500 FT. IN THIRTY MINUTES ON NARROW-GAGE INCLINE

was mounted directly on two double trucks such as are used on the cars of the narrow-gage inclined railway. The section was laid on curved blocks securely fastened to the trucks by means of chains. The section was then lowered with the cable from a 150-hp. electric hoist. By this method a section 8 ft. in diameter and 22 ft. long, weighing 8 tons, was lowered a distance of 1,500 ft. along the inclined railway, paralleling the penstock line, in thirty minutes. R. C. Starr is the construction engineer of the company.

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Reducing Losses in a Boiler Room

ECONOMY obtainable in a boiler room is limited by the losses which are reducible and those which are non-reducible. The reducible losses are the larger class. They may be reduced by (1) better operation and (2) better equipment. Assuming that the equipment cannot be changed, there are a number of chances for improving economy by improving operation. Table I shows that fuel amounts to from 50 to 75 per cent of the production cost in a number of typical plants. Table II shows the reducible losses which occur in the combustion of this fuel. This table shows that good furnace design will be of little avail if cracks are allowed to remain open in boiler settings, baffles to remain warped and burned out, and tubes to be covered with soot.

After everything possible has been done in improving the combustion of the fuel and delivering its heat to the boiler tube, the next care is the inside of the tube. In its raw state hardly any water is good enough for boiler feed without purification. The proper treatment to be applied must be determined for each individual plant, as a chemical preparation which is effective in one place will probably not be effective in another, and even when used at the same place over an extended period will fail to give uniform results. The only sure way is to have frequent analyses made and apply the remedies which those analyses show to be necessary. However, boiler compounds cannot be depended on for universal relief. Another method of keeping scale out, in a condensing plant, is by evaporation of the make-up. The cost of this method may be obtained from the following figures showing the arrangement of evaporation equipment and the pounds of distillate produced per pound of steam: Quadruple effect, 2.81; triple effect, 2.28; double effect, 1.65; single effect, 0.9.

Losses in heat transmission will increase with the thickness of scale, and for thicknesses up to $\frac{1}{8}$ in. such losses may reach 12 per cent. It has been found that a thin film of grease is more harmful than thick scale, because it prevents contact between the water and the boiler surfaces. Every effort, therefore, should be made to extract oil and grease from exhaust steam used for heating feed water. The installation of an oil separator with open feed-water heater will give relief, but this piece of apparatus must be inspected in order to get the best results.

As the chief item entering into cost of production is fuel, the men in the power plant should be urged to

TABLE I—ELEMENTS OF PRODUCTION COST IN POWER PLANTS*

	Per Cent of Total						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Fuel	51.2	61.8	67.9	68.7	70.4	75.0	69.0
Labor	29.5	18.8	11.0	19.4	17.9	17.4	18.0
Maintenance	15.8	14.3	17.3	6.7	8.1	3.5	9.0
Miscellaneous	3.5	5.1	3.8	5.2	3.6	4.1	4.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Plants Nos. 1, 3 and 5 are oil-burning and have 705,570 kw.-hr., 1,604,430 kw.-hr. and 1,710,410 kw.-hr. yearly output respectively. Nos. 2, 4 and 6 are coal-burning and have 681,230 kw.-hr., 2,208,220 kw.-hr. and 4,347,400 kw.-hr. yearly output respectively. Plant No. 7 is an average of large power-plant operation with approximate average yearly output of 79,000,000 kw.-hr. All figures are for twelve months ended November, 1920.

TABLE II—HEAT LOSSES IN AN AVERAGE BOILER ROOM*
(In percentage of heat in coal)

		Per Cent Loss †
1.	Handling coal at plant	1.0
2.	In ash	2.5
3.	By radiation	2.5
4.	By incomplete combustion	0.7
5.	On account of air leakage in furnace and boiler	2.5
6.	On account of excess air through grates	4.0
7.	Due to short-circuiting of gases in gas passages of boiler	0.8
8.	Due to soot on heating surface	2.0
9.	Due to scale in boiler	5.0
10.	Due to incorrect draft or load	2.5
11.	Due to leakage of water and steam	0.5
	Total reducible loss	25.0

*About 15 per cent of the heat in the coal delivered to the power plant is lost non-preventably in the boiler; approximately 80 per cent of this is lost up the chimney in maintaining draft.

†These figures were arrived at by use of data contained in "Fuel and Combustion Engineering," by Joseph W. Hays, and from other sources.

study the economical combustion of fuels. The day when any man who could wield a shovel was good enough to be a fireman has gone by. It is the duty of central-station executives to select men for the boiler room with as much care as for the engine room.

Since fuel is the largest item, care should be taken to see that the money expended for it purchases heat and not weight. The heat per pound in coal from various mines may differ greatly.

The necessity for covering with heat-insulated material all live-steam piping and exhaust-steam piping used for heating feed water is well appreciated. However, even with the most efficient covering there must be some condensation. The ill effect of wet steam on the economy of both the reciprocating engine and the turbine and the erosive action of wet steam on turbine blades are also well known. To overcome these difficulties the writer believes that a moderate amount of superheat—say at least 75 deg.—should be added to the steam so that the prime movers may be assured of dry steam.

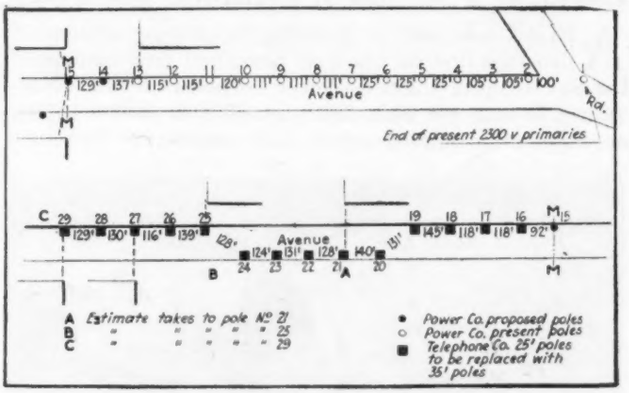
C. A. GREENIDGE,
Chief Engineer.

J. G. White Management Corporation,
New York City.

Cost of 2,300-Volt Single-Phase Extensions

AN ESTIMATE of the comparative costs of extending a residential primary 2,300-volt, single-phase line to serve seven, five and four proposed customers was recently prepared by an electric service company in the Northeast in connection with a discussion of the financing of such extensions. These data are based on construction and material costs prevailing about Jan. 1, 1921.

Estimate A involves serving seven customers, the last being 3,408 ft. from the end of the present primaries; estimate B provides for serving five customers at 2,894 ft. maximum distance, and estimate C covers four customers, with a maximum run of 2,373 ft. The extensions require the setting of two additional poles by the company, the addition of a primary circuit and the replacement of existing 25-ft. telephone poles by 35-ft. poles for joint occupancy, with rebuilding of the telephone line. The accompanying diagram shows the position and spacing of the poles and indicates where new poles must be set and old ones replaced.


Avenue
End of present 2300 v primaries
Avenue
Rd.
Estimate takes to pole No 21
" " " " 25
" " " " 29
Power Co. proposed poles
Power Co. present poles
Telephone Co. 25' poles to be replaced with 35' poles

LAYOUT OF 2,300-VOLT LINE, OF WHICH COSTS ARE GIVEN IN TABLE

The estimated cost of making an extension to serve seven customers totaled $1,186.34; to serve five, $938.41, and to serve four, $725.28, including overhead material, services, transformers and meters. On account of their engineering interest the detailed estimates are printed herewith.

FIELD EDITOR ELECTRICAL WORLD.

Boston, Mass.

COST OF EXTENSIONS ON 2,300-VOLT, SINGLE-PHASE OVERHEAD SYSTEM
(Based on Jan. 1, 1921, prices)

Item	Unit Cost	Estimate A—3,408-Ft. Extension to Serve Seven Consumers: No. of Units	Cost	Totals	Estimate B—2,894-Ft. Extension to Serve Five Consumers: No. of Units	Cost	Totals	Estimate C—2,373-Ft. Extension to Serve Four Consumers: No. of Units	Cost	Totals
Poles and fixtures:										
No. 6 weatherproof triple-braid wire (lb.)	$0.3124	900	$281.16		750	$234.30		625	$195.25	
4-pin cross-arms	1.20	15	18.00		15	15.60		9	10.80	
2-pin cross-arms	.90	9	8.10		5	4.50		4	3.60	
1½-in. x 9-in. cross-arm pins	.0404	78	3.15		62	2.50		44	1.78	
Pairs cross-arm braces	.29864	24	7.17		18	5.38		13	3.88	
2½-in. x 2½-in. square galvanized washers	.0268	48	1.29		36	.96		26	.70	
½-in. round washers	.0538	48	.18		36	.14		26	.10	
13-in. x ⅝-in. machine bolts	.02552	...	...		...	...		13	.1.63	
4-in. x ½-in. lag bolts	.0409	...	...		18	.74		13	.53	
14-in. x ⅝-in. machine bolts	.13302	24	3.19		18	2.39		...	...	
4½-in. x ⅝-in. carriage bolts	.0321	48	1.54		36	1.16		26	.83	
Westinghouse insulators, S195146	.2043	74	15.12		56	11.44		50	10.22	
35-ft. class A poles	20.00	2	40.00		2	40.00		2	40.00	
Labor, hours	.75	175	131.25		150	112.50		140	105.00	
			$510.15			$431.61			$374.32	
Contingencies, supervision, etc., 10 per cent		...	51.01		...	43.16		...	37.43	
Attachments to N.E.T. & T. Co. poles		...	322.00		...	230.00		...	138.00	
Transportation (days)	6.00	4	24.00	$907.16	3	18.00	$722.77	3	18.00	$567.75
Services:										
No. 2881G three-point spreader brackets	1.479	7	10.35		5	7.49		4	5.92	
No. 33 porcelain insulators	.045	28	1.26		...	...		...	...	
Westinghouse insulators, S195146	.2043	...	...		20	4.09		16	3.27	
No. 6 weatherproof triple-braid wire (lb.)	.3124	125	39.05		60	18.74		50	15.62	
House hooks, No. 22 Beardsley brackets	.2569	14	3.60		10	2.57		8	2.06	
Labor, hours	.75	26	19.50	73.76	15	11.25	44.05	12	9.00	35.87
Transformers:										
1-kva. transformer	35.28	2	70.56		3	105.84		2	70.56	
2-kva. transformers	49.56	1	49.56		...	...		...	...	
Labor, hours	.75	12	9.00	129.12	15	11.25	117.09	10	7.50	78.06
Meters:										
10-amp., 110-volt I-14 meters	9.40	7	65.80		5	47.00		4	37.60	
Labor, hours	.75	14	10.50	76.30	10	7.50	54.50	8	6.00	43.60
Grand totals				$1,186.34			$938.41			$725.28

Spray Pipes in Superheated Steam Line Improve Engine Lubrication

THE use of superheated steam interfered with the lubrication of high-speed engines used during the peak load in the Cortland County Traction Company, Cortland, N. Y. Consequently it was necessary to install small spray pipes ahead of the steam separators in the lines leading to these engines for the purpose of cooling down the steam. In spite of the inefficiency of this scheme, it enabled the company to carry its load over the peak period.

F. A. Dresser, chief engineer of the company, mentioned this experience at a recent meeting of the Empire State Gas and Electric Association.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Cover Should Be on Meter While Testing

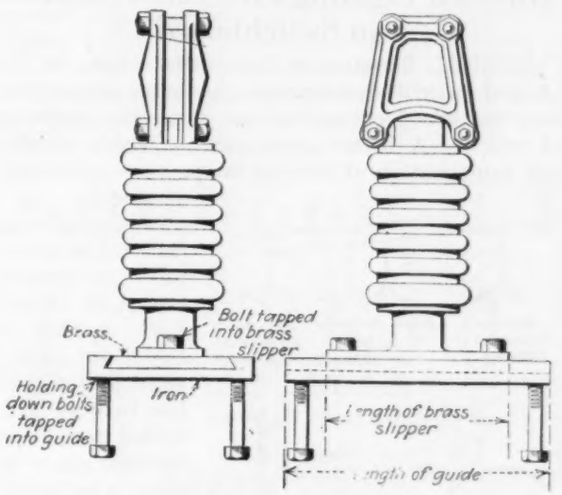
THAT covers should be in place on meters being tested on the customers' premises was recommended by the meter committee of the Southeastern Section, N. E. L. A., at the recent Miami meeting. The main reason for such practice is that the meters operate with covers on and that test conditions should duplicate service conditions as nearly as possible. Moreover, five companies of this section report that when testing large power meters with heavy cast covers the removal of the covers affected the results of the test. This change was not due to drafts, which might affect any meter, but was probably caused by magnetic shielding when the cover was in place. S. A. FLETCHER,
Alabama Power Company, Superintendent of Service.
Birmingham, Ala.

Keeping Records of Insulators Found Defective on Line

FOR keeping records of insulators on the lines found defective by tests the instructions shown here are carried out by the patrolmen of a large central station. These records show the exact location of the insulator, the kind of insulator, the type of line, etc. The records are kept in an engineer's level book carried by the patrolman, and the instructions are pasted in the book.

Sliding Base Prevents Breakage of Post-Type Insulator

A SLIDING base to allow for the expansion of heavy buses has put an end to a considerable breakage of post-type insulators that had been customary in a Canadian power company's station. A heavy busbar of some length and supported rigidly on post-type insulators was giving trouble because of the tendency of the insulators to break off. Upon investigation it was found this was due to the expansion of the bus when operating heavily loaded. Many remedial schemes were thought of—such as expansion joints in the bus—but no other would have been so effective as the post-type insulator with the sliding base shown in the figure. The base consists of two separate parts, one the brass slipper which is attached to the insulator and the other the guide in which the slipper moves. The guide is of gray cast iron machined as shown. When the bus changes its length no strain is put on the insulator as it is free to slide with the bus. R. H. N. LOCKYER.
Trail, British Columbia.



THIS INSULATOR SLIDES TO CONFORM WITH VARYING LENGTH OF BUS

INSTRUCTIONS FOR KEEPING RECORDS OF INSULATORS FOUND DEFECTIVE ON LINES BY TESTS

These records should be kept in Dietzgen Engineer's Level Books No. 411.

A copy of these instructions should be pasted in the front of each book used for this purpose.

The name or number of the line should be placed at the top of the left-hand page.

The kind and number of the instrument used in test should be noted at the top of right-hand page.

Column 1, "Structure Number," should give the number of the pole or tower or its location.

Column 2, "Construction," should state whether wire arrangement is flat, vertical or triangular.

Column 3, "Wire," should indicate which wire was supported by the insulator.

For flat construction, indicate the wire as north, south, east, west or middle—N. S. E. W or M.

For vertical construction, indicate the wire as upper, middle or lower—U. M. or L.

For triangular construction, indicate the wire as upper north, south, east or west, or lower north, south, east or west, or upper or lower—UN, US, UE, UW, LN, LS, LE, LW, U or L—as the case may be.

In using the directions, use the one which most nearly applies. If two apply equally well, use the one which the general direction of line indicates as being correct.

Column 4, "Susp., D.S., D.E. or T.D.," should indicate whether the defective insulator was in a suspension, double suspension, dead end, or tie-down string.

Column 5, "Side of Support, D.E.," should show whether the defective insulator, if in a dead-end string, was north, south, east or west—N. S. E or W.—of the cross-arm or other support.

Column 7 should show the position of the defective units in the string, counting the one nearest the support—farthest from the conductor—as number one. Group together in this column all the defective units in one string of insulators.

Column 8 should indicate whether the insulator hardware is grounded or not grounded—"G or NG."

Column 11 should show date of installation. If day and month are not known, give year, if known.

Column 12, "Kind of Insulator," should give all that can be given to identify the failed insulator. If the insulator is stamped in the porcelain on the under side with a figure representing a three-petticoat pin-type insulator with the word "Victor" across it, or if the word "Victor" is anywhere on the insulator, write "Locke" in this column.

If there is an "O" with a "B" inside it anywhere on the insulator, write "OB."

If the manufacturer's number is known, it should be written after the "OB" or the "Locke."

If there is a number cast in the cap, such as 517, C-517 should be written in this column.

If there is a number cast in the pin, such as 312, P-312 should be written in this column.

If there is a letter or number, or both, stenciled on the cap such as the letters 1A, then S-1A, should be written in this column.

If there is a gasket under the cap, the letter "G" should be written in this column.

If the insulators are joined by a ball and socket connection instead of the pin and clevis connection, "B" should be written in this column.

If there are any remarks to be made which will give any information in regard to the insulators, they may be written all the way across the double page on the next line or lines below, continuing the tabulation below these remarks.

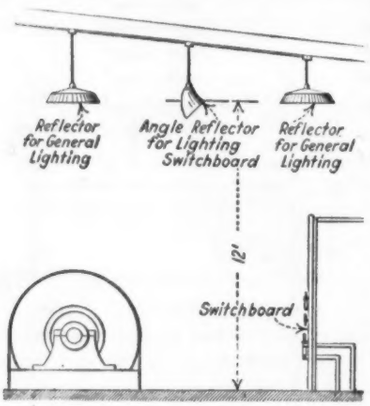
On other pages of the field book, tally in separate columns all the suspension insulators and all the dead-end insulators tested. Include tie-down insulators in the suspension insulator tally. Be sure to date these tallies.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Directed Lighting Eliminates Shadows on Switchboard

GENERAL illumination is unsatisfactory for a vertical switchboard, because the lamps placed directly above the board cause shadows upon the instruments and relays. A better arrangement, which avoids the extra complication of bracket lamps over individual instruments, is to mount angle-type reflectors, as shown in the accompanying sketch, to throw the light directly upon the board from the front and above. If the lamps are installed near the roof, the clear space in the room is not obstructed and the operator does not cast a shadow upon the board. In the installation illustrated, which was made by Stone & Webster, Inc., at the Kokomo (Ind.) plant of the Pittsburgh Plate Glass Company, the special illumination of the board is provided by 200-watt lamps mounted 12 ft. above the floor, and the "line-up" does not mar the appearance of the station. H. B. WOOD.



ANGLE REFLECTOR LIGHTS FRONT OF SWITCHBOARD AND HAS PLEASING APPEARANCE

Boston, Mass.

Care of Control and Motor of Shop Tractor

TO KEEP electric shop tractors in good running condition the controller and the motor must constantly be looked over carefully to guard against troubles which may develop. The controller gets considerable wear every day owing to friction, stopping and starting, and inching along by degrees, and therefore it should be examined every few days, cleaned of copper dust, and a few drops of oil applied to prevent cutting of sliding parts. If the contacts or fingers are worn short or badly pitted, new ones must be put in as soon as possible or the tractor may stall in an inconvenient location. New contacts and fingers should always be kept in stock, care being taken when ordering from the manufacturer to give not only the part number but also the type and number of the machine for which they are intended.

The controller handle should be given a few drops of oil every morning as its shaft turns a great number of times in a day's routine. Some tractors have three speeds on the controller and two on the brake pedal obtained by means of resistance coils. In ordinary running this pedal must be held all the way down. The coils may become red hot if the controller receives too much current and the pedal is operated only partly down, thus allowing the excess current to be dissipated in heat instead of producing power. The pedal may also operate the main switch which is in line with the controller, and here, too, much wear of the contacts may be caused by careless operation. The switch, like other current-carrying parts, should be cleaned and oiled every few days, and when necessary be renewed to avoid burning and flashing.

All leads to the motor, controller and switch should be well taped together to prevent mechanical injury and painted to withstand water. Moreover, all leads must be tightly connected at their terminals or heating may result, as current higher than usual flows at times in order to attain sufficient horsepower at low voltage. The motor, being about 1 hp. or 1½ hp. in size and operating on perhaps 30 volts to 45 volts, will draw at the least 25 amp.

The bearings of the motor should receive a few drops of oil every few weeks. The commutator should be wiped clean and the brushes should be made to work freely in their holders. When in use the commutator end must be kept always covered by a sheet-iron band to prevent water and dirt from entering the motor. If the ball-bearing races in the motor are worn badly, new ones can be inserted in a short time. This will prevent the armature from striking the poles. When time cannot be spared to repair the motor it can be unbolted, slipped out readily and a spare unit put in its place. To try the motor with the tractor standing idle simply jack up one driving wheel, which will revolve through the differential when power is applied. H. S. RICH.

East Berlin, Conn.

Baking Partially Rewound Armatures and Fields

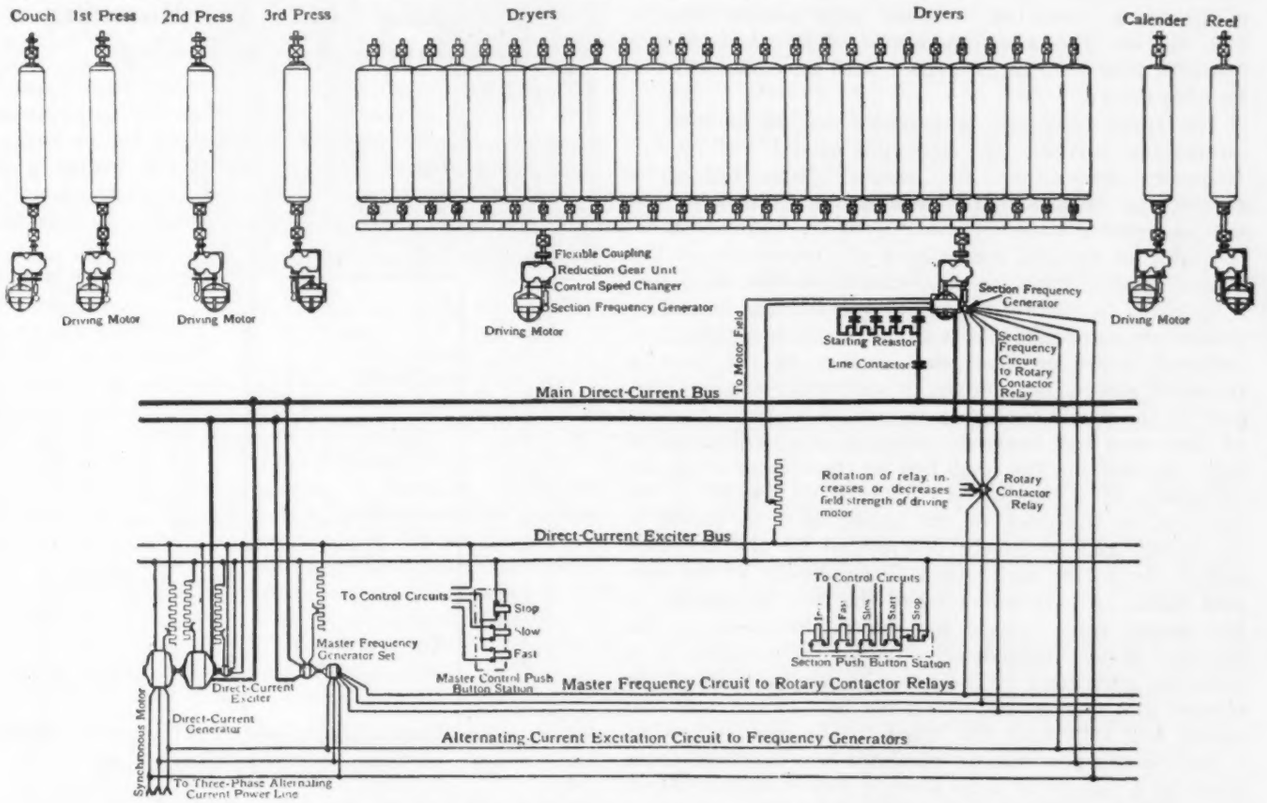
SPECIAL treatment is required when baking armatures and field coils which have been only partially rewound with new coils. In the plant with which the writer is connected they are first very carefully cleaned on the outside. They are then washed in a special "high-test" gasoline. Samples of all gasolines which are used for this purpose receive a distillation test, to make sure that they contain no considerable quantities of heavy "non-volatile" oils. After the old coils have been carefully soaked and washed out with this gasoline they are baked for at least twenty-four hours at about 100 deg. C., and if the parts are small they are baked in vacuum. The coils are then dipped hot in a standard baking varnish and baked for at least twenty-four hours on the first baking. They then receive a second dip hot and are baked for twelve hours, then given a coat of air-dry varnish. It is endeavored to keep the ovens at from 75 deg. to 100 deg. C. and well ventilated.

Newark, N. J. F. W. GAY.

Automatic Speed Control for Sectionalized Paper-Mill Machine Drive

TO MAINTAIN the fine gradations of speed in the rolls of a paper machine, particularly between the sections of a machine, has made the changing to electric drive a difficult problem. A somewhat novel method of automatic regulation of the speed of the sections has been employed successfully in the mills of the West Virginia Pulp & Paper Company, Tyrone, Pa., and the Gould Paper Company, Lyons Falls, N. Y. No difficulty has been experienced with speed variations.

The system of sectional paper-machine drive and control consists of an adjustable-voltage, direct-current generator, of sufficient capacity to drive the entire paper machine, with direct-connected exciter; a direct-current adjustable-speed motor for each section of the machine, suitable means for connecting the motor to each section of the paper-machine driving shaft, and a control system which automatically maintains the correct speed of each individual motor, together with push-button stations for starting, stopping and adjusting the speed of the paper machine as a whole.



AUTOMATIC SPEED-CONTROL ELECTRIC DRIVE FOR PAPER MACHINES WHICH GIVES CLOSE SPEED REGULATIONS

Heretofore mechanical drive has been used almost exclusively for the various sections of the paper machine. The reason motors have not been used for driving the individual sections was because no means had been found whereby their speeds could be controlled accurately enough to prevent breaking of the paper, most of the trials of sectional motor drive having resulted disastrously. From the fact that the relative speeds of the sections have to be adjusted from time to time, synchronous motors are out of the question, and induction motors, on account of their inherent regulation characteristics, are equally unsuitable. Direct-current motors, on the other hand, can be designed to operate over wide ranges of speed and offer great flexibility of control, and the only thing that has interfered with their general adoption has been the absence of a suitable type of speed regulator. Recent investigations have shown that to prevent breakage or undue straining of the paper as it passes from one section to another the variation of speeds between sections must be maintained, as an average value, within one-tenth of 1 per cent. It is also necessary to raise or lower the speed of the entire paper machine by small amounts from time to time, without interfering in any way with the draw or relative speeds of the various sections, and it is necessary when changing from one grade of paper to another to operate at widely different speeds, speed variations of seven to one or even ten to one frequently being encountered.

The generator usually forms part of a standard synchronous motor-generator set or turbine-generator unit, and is a 250-volt, adjustable-voltage, separately excited machine with a constant-voltage 250-volt exciter of sufficient capacity to furnish excitation for the synchronous-motor field, the generator and motor fields, and for the control circuit of the regulator. The motors are 250-volt separately excited machines and may be of any desired speed, dependent upon the particular requirements of the paper machine involved. Where a comparatively small range of speed for the paper machine is desired—that is, not more than three to one or four to one—this is accomplished by voltage control of the generator through a motor-operated field rheostat. Where very wide ranges of speed, such as ten to one, are required, both generator-voltage control and motor-field control are used, the same motor-operated face-plate controller or rheostat serving to

insert resistance in the shunt fields of the several motors uniformly, after the generator has been brought to full voltage.

The automatic control system consists of a small master frequency generator driven by a small direct-current motor operating in parallel with the section driving motors and separately excited; a small frequency generator driven from each of the section driving motors through a small speed changer consisting of two cone pulleys, to one of which the frequency generator is coupled; a powerful synchronous type of rotary relay for each driving motor, which serves to make an electrical contact in one direction or the other on the slightest unbalance of frequencies, and a motor-operated field rheostat, under control of the relay, in the shunt field circuit of each driving motor. The master frequency generator is common to all sections of the paper machine, whereas each section has its own section frequency generator, relay and motor-operated field rheostat, together with an effective anti-hunting device.

The small frequency generators are all excited by alternating current, but since the master and section frequency generators are excited from the same source, any variations in frequency or voltage of the exciting source have no effect upon the regulation, as they do not disturb the balance of frequencies at the rotary relay. Since no appreciable amount of power is required to operate the rotary relay, these frequency generators are small in size. The small speed changers referred to are of small size, as they do not have to transmit power, but simply to overcome bearing friction of the small frequency generator and the friction of their own ball bearings, which is practically negligible. By shifting the small belt on these speed changers by means of a handwheel, the relative speeds of the sections, or the draw of the paper, as it is called, is accurately and positively determined by the operator and is thereafter maintained automatically at the correct value. Any unbalancing of the two frequencies at the rotary relay caused by change in speed of the driving motor immediately causes a positive synchronous movement of the relay, making an immediate contact and thereby adjusting the field strength of the motor and returning the speed to the required value.

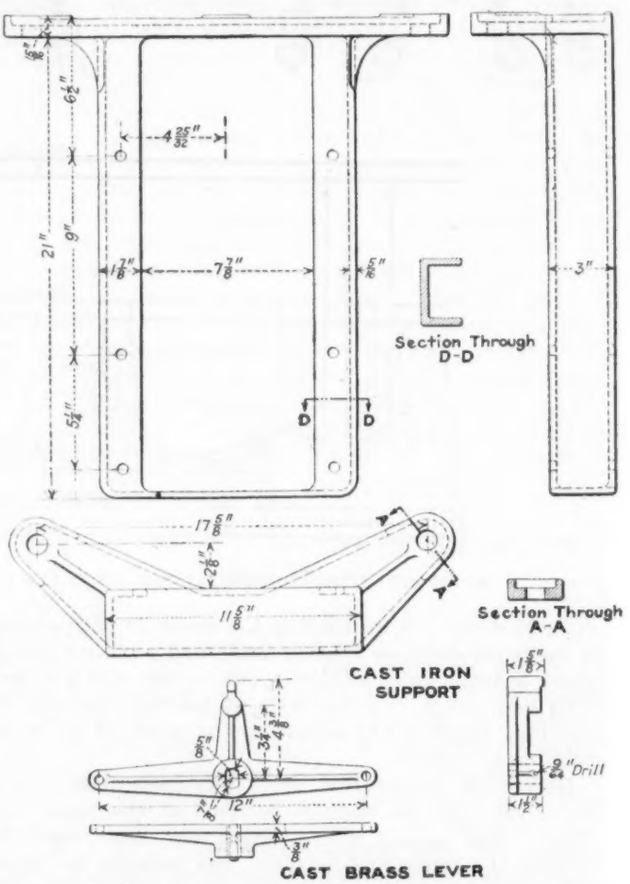
Before any governor or regulator can function, there must be a change of some kind in either load or speed, as otherwise there would be no occasion for the regulator to correct anything. However, these changes in speed need not be large enough to be perceptible to the eye or detectable by ordinary indicating apparatus in order to actuate this new regulator. In fact, the regulator will detect changes in speed of a few thousandths of 1 per cent and make the necessary correction immediately, and without any tendency to overtravel or hunt, so that no perceptible change will be found in the draw of any section.

A control board is provided in connection with each paper machine, having a master control panel for the paper machine as a whole, controlling the generator and master frequency generator, and a unit section control panel for each of the section driving motors. Starting equipment is provided on each of these panels, consisting of motor-operated cam-accelerating switches with line contactors under the control of suitable push-button stations for starting and stopping the individual motors and the entire paper machine as a whole. The master rheostat, under push-button control, provides means for adjusting the speed of the paper machine as a unit over the entire range of speed. The rotary contactor relay and motor-operated field rheostat for each section are also located on the unit-section control panel. The push-button stations, arranged conveniently on or near the apparatus, provide means for starting, stopping and obtaining any desired speed of the paper machine in the shortest time and in the most efficient possible manner. In this way and in the elimination of the cumbersome mechanical drive a great deal has been accomplished in increasing production and improving over-all efficiency and economy from every standpoint.

STEPHEN A. STAEGE.
General Engineer.
Westinghouse Electric & Manufacturing Company,
Pittsburgh, Pa.

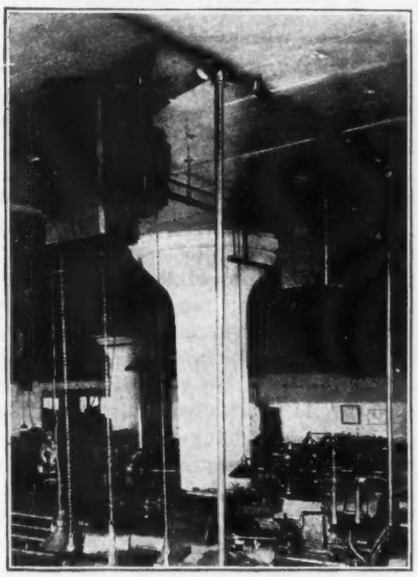
Supporting Frame for Mounting Compensators on Ceilings

IN ORDER to save working space and wiring expense in the plant of the Dayton Engineering Laboratories Company compensators are mounted on the ceiling by means of cast-iron supports. With the compensators so mounted, the motors are started by chains hanging down within easy reach of the operator. In this factory two different sizes of mounting supports have been found necessary. One is used for compensators up to 25 hp., rated at 220 volts or 440 volts, and this one is shown in the accompanying photograph and drawing. The other size is for motors of 30 hp. to 100 hp. It was described in ELECTRICAL WORLD, Feb. 19, page 435.



CAST-IRON CEILING SUPPORT AND STARTING LEVER FOR LOW-VOLTAGE COMPENSATORS UP TO 25 HP.

The compensator, as may be seen from the photograph, is bolted to the support. Hanging from the compensator are three chains. Two of these hang from a brass arm mounted on the lever on which the starting handle of the compensator is usually mounted. By pulling these chains, first one and then the other, the motor is started and brought up to speed. The third chain is connected on to the lever for tripping the compensator. One of the reasons advanced for the use of automatic compensators is that manufacturing floor space is saved by mounting them overhead or at a distance. The same saving of space, however, is accomplished with these supports without the expense of the automatic feature. This method of mounting not only saves space, but practically the entire run of conduit from the ceiling to the floor is eliminated. It also facilitates inspection from a distance, as the inspector can see at once by the position of the starting lever whether the compensator is in the running, starting or off position. It has been found that this mounting does not materially increase the time required for periodical examination.



COMPENSATORS MOUNTED ON CEILING EASILY OPERATED BY MEANS OF THREE CHAINS

H. L. BURNS,
Chief Electrician.
Dayton (Ohio) Engineering Laboratories Company.

Operating Records of Electric Furnaces Refining High-Grade Steels

ENERGY consumption per ton of steel refined, time of melting, pounds of electrode consumed per ton, etc., are shown in the accompanying table, giving averages of a year's performance of electric furnaces operated by the United Alloy Steel Corporation, Canton, Ohio. This firm makes high-grade steel, steel castings and ferro-alloys, employing three Heroult furnaces and two Snyder furnaces. There are two 15-ton Heroult furnaces and one 6-ton furnace. All are operated on three-phase, 60-cycle energy at 110 volts from Westinghouse 3,000-kva. transformers. Thury automatic control is used. The two 1-ton single-phase Snyder transformers are operated through a 600-kva. Westinghouse transformer and are hand-controlled. The Heroult furnaces melt and refine steel and are charged with hot and with cold metal. The Snyder furnaces, used for making steel castings and ferro-alloys, are charged hot. The value of electric furnaces for refining purposes is indicated by the fact that steel containing only 0.008 per cent of sulphur and 0.015 per cent of phosphorus can be produced consistently in them.

It is seen from the table that the energy consumption per ton of metal produced is 568 kw.-hr. for the Heroult furnaces melting cold scrap and 168 kw.-hr. when the charge is already molten. The 2-ton furnaces require 1,002 kw.-hr. to melt and refine cold metal. The electrode consumption on the Heroult furnace was 26.6 lb. per ton of steel. This includes electrodes for both the cold-charge and the hot-charge processes. In the Snyder furnaces the consumption was 41.4 lb. of electrode per ton.

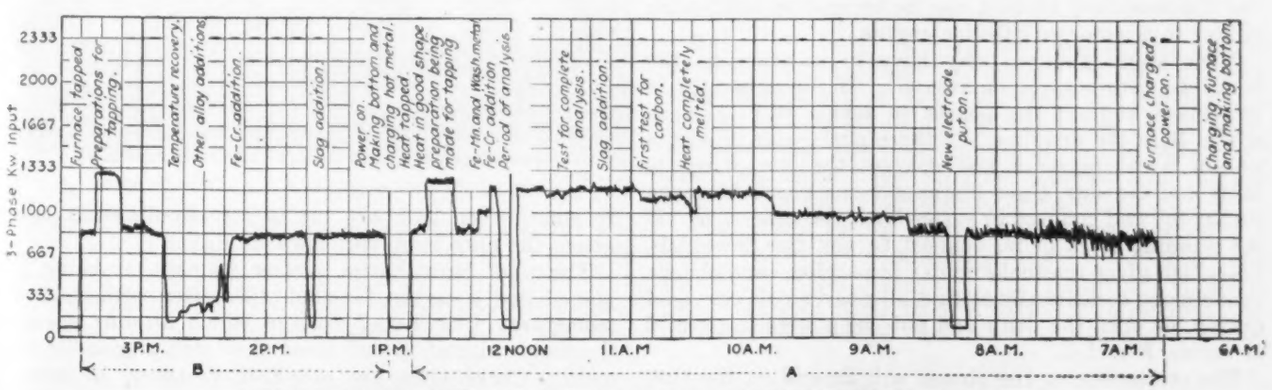
ENERGY CONSUMPTION, ETC., OF FURNACES MELTING AND REFINING STEEL

	Heroult Three-Phase Furnaces (Two 15-Ton and One 6-Ton) Hot-Metal Charge	Heroult Three-Phase Furnaces (Two 15-Ton and One 6-Ton) Cold-Metal Charge	Two 1-Ton Snyder Single-Phase Furnaces, Cold-Metal Charge
Average kw.-hr. per ton (gross)	168	568	1,002
Average charging time (min.)	15	55	30
Average melting time (hours)	...	5	5
Average number of heats per ten hour day	3	1	1.5
Pounds electrode per ton steel	26.6*	26.6*	41.4
Gross tons refined per year	10,209	7,580	329
Number of heats made in year	636	470	152
Arc voltage	110	110	110
Transformer rating (kva.)	3,000	3,000	600

* Average for hot-metal charging and cold-metal charging.

Load curves of one of the 15-ton furnaces melting cold metal for magnet steel and refining hot-charged metal for ball bearings are reproduced here. It has been this company's experience that a high melting-down current reduces the kilowatt-hour consumption and produces better steel as there is less time to absorb oxides. Moreover, better refining results from using a high current just before the heat is tapped.

United Alloy Steel Corporation, Canton, Ohio.
M. H. SCHMID,
Metallurgical Engineer.



KILOWATT INPUT TO 15-TON HEROULT FURNACE PRODUCING HIGH-GRADE STEELS

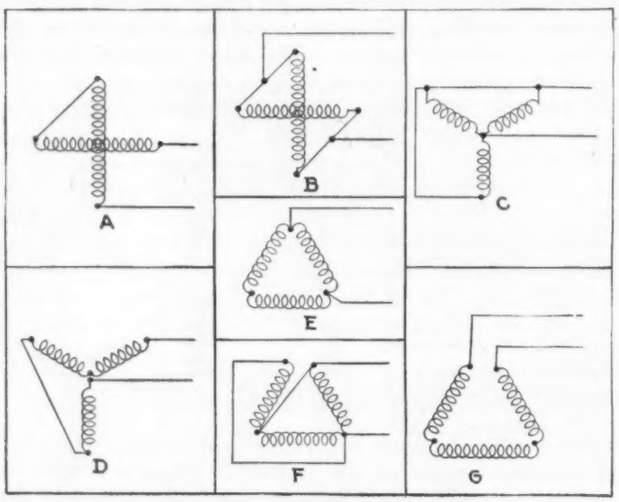
A—Furnace charged with 38,000 lb. of cold scrap, making magnet steel containing: C., 0.86 per cent; Mn, 0.43; S, 0.021; P, 0.022; Si, 0.28; Cr, 2.07; W, 0.90.

B—37,500 lb. of metal charged hot for making ball and race steel of the following analysis: C, 0.96; Mn, 0.36; S, 0.020; P, 0.018; Si, 0.12; Cr, 1.55; Va, 0.17.

Drying Out Motors and Generators

TO DRY out a motor or generator it is only necessary to pass full-load current through the coils while the machine is standing still. As the ventilation is poor when the machine is not running, the temperature of the coils will quickly rise to 75 deg. or 80 deg. C.

In drying out alternating-current generators it is customary to short-circuit the winding and operate the machine at reduced speed and with just sufficient field to cause about one and a quarter times full load current to be generated. This is an excellent method, but has the objectionable feature that it cannot be used until the machine in all other respects is ready to put into service. It takes from two to six days to dry out a winding properly, depending on the length of time the machine has been exposed to moist air. When in pressing need of additional generator capacity this is serious



CONNECTIONS WHICH MAY BE USED WHEN DRYING OUT ALTERNATING-CURRENT MACHINES

delay. This delay may be avoided by starting the drying-out process as soon as the machine is assembled and without waiting for the prime mover to be in running order. To do this it is only necessary to connect the stator winding to the direct-current bus with the main-field rheostat in series and adjust the resistance so that not more than normal full-load current will flow in the winding. Thermometers should be inserted in several places and care taken that a temperature of 75 deg. or 80 deg. C. is not exceeded. If there is no direct-current bus, the necessary current may be secured by belting the exciter to a motor or gasoline engine.

Some slight changes may have to be made in the windings before applying current. If the generator is two-phase, connect the phases in series or parallel as *A* and *B* in the drawing. If three-phase star, bind the lead-in wires together and connect the line wires to these and the star, *C*, or disconnect one phase from the star point and connect in series with the others, *D*. If the winding is in delta, connect to any two terminals, *E*—which gives unequal circuits in parallel—and change connections occasionally so that all phases will get equal drying, or open the delta and put the phases in parallel or series, *F* and *G*.

The connection of the phases will depend on the size, speed and voltage of the generator and may be determined by trial or by measuring the resistance of a phase and calculating the current that would flow in a series or parallel connection.

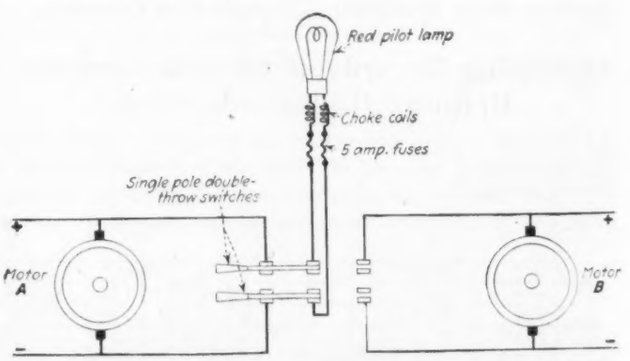
AMÉDÉE ANCTIL,
Brown Company, Electric Repair Department.
Berlin, N. H.

Pilot Lamp Indicates Operation of House Pumps

MUCH annoyance was caused some time ago by failure of the automatic devices on a pair of triplex house pumps in a St. Louis plant to operate promptly at proper times. Occasionally the pumps would not start when the water had receded to the normal low level, and no sign of this was evident.

To compensate for this defect, the engineer decided to install a red pilot lamp where it would show conspicuously on the switchboard in the engine room. Then, if the pilot lamp ceased to glow for more than a few minutes, the attendant would know that the pump motor had failed to respond to the demand for water and would correct the trouble accordingly. The pumps are operated by 110-volt direct-current motors. They are intended to work together or independently, as service conditions may require. They are installed in a remote part of the plant, removed from constant observation by the attendants. The motors which drive them are equipped with automatic starting and stopping devices.

The wiring of the pilot lamp is shown in the sketches herewith. The apparatus is connected to the positive and negative brush holders of each motor with wire of No. 14 B. & S. gage. When only one of the pumps is required, both of the single-pole, double-throw switches are thrown so as to close the pilot-lamp circuit through the armature of the motor which drives the pump. Thus, in the drawing, the pump motor *A* is in service while the pump motor *B* is inactive. Hence the pilot-lamp circuit is switched in parallel with the armature of motor *A*. But when both pumps are required the switches are thrown in opposite directions. The current then passes from the positive brush of one of the motors, through the pilot-lamp circuit, and thence to the negative brush of the opposite motor. If either motor fails



LAMP CONNECTED ACROSS MOTOR BRUSHES INFORMS DISTANT OPERATOR IF MOTOR IS NOT CONNECTED TO LINE

to start, when both are cut in for simultaneous operation, the pilot lamp will show no light.

The pilot lamp has a carbon filament, it being assumed that a carbon filament will better withstand the momentary increase of voltage which attends opening the motor circuit at full speed than will a metallic filament. Choke coils are provided, however, to protect the lamp from thes urge of current thus produced.

St. Louis, Mo. A. J. DIXON.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Utility Employees Acquaint Directors with Operating Details

TO EXPLAIN and discuss various features in connection with the design and operation of the company's properties and of its organization, the Southern California Edison Company has inaugurated a plan whereby different heads of departments and employees meet with the directors periodically. Papers are prepared which are read before the directors, after which there is an opportunity for the directors to ask questions and generally discuss the subjects brought up.

One subject in which the directors have shown particularly keen interest concerns the method of operating the many interconnected hydro-electric and steam generating stations to insure maximum economy and output. It is expected that these meetings will bring about the closest co-operation between all departments of the organization.

Continuous Sale of Preferred Stock at Par

THE Union Electric Light & Power Company of St. Louis has sold to consumers well over $3,000,000 of 7 per cent preferred stock at par since early in 1917, and from the beginning of its home financing activities the company has addressed itself to that large field of small investors ordinarily closed to the investment banker and broker. In commenting on the subject an official of the company stated that when the home financing of capital requirements was decided on the company found itself in a strong position. Its rates were equitable, its service was of a high order, and its

WINDOW DISPLAY WHICH PROMOTED STOCK SALES

outstanding capital was of a legitimate amount and character, as testified to by an appraisal of its property made by the Public Service Commission of Missouri. The desirability of having the largest possible number of home partners was recognized, and plans were laid along lines which are not comparable to those of the orthodox banker and investment broker.

The first step was an educational one, and through the daily press the public was told all about the company. The advertisements headed "On the Job Twenty-four Hours of Every Day" and "Getting Right with Our Employees," reproduced here, are fair examples of the good-will advertising.

To a field cultivated in this manner the company announced the offer of $500,000 of 7 per cent preferred

Getting Right With Our Employers

Our employers? That's you—the public—850,000 of you in St. Louis city and county.

Union Electric serves 88,000 of you, and your families, employes and customers, under individual contracts. We serve all the rest of you, in one way or another, under rules and contracts made by your city and state governments.

No doubt about our being public servants.

The public hires us for this job of supplying Electric Service because you believe we can do the work better and cheaper than any other agency, corporate or municipal.

Union Electric is dead willing to bet its job and its $31,105,000 investment on its ability to do that.

But to do it, we must have your good will, so far as we fairly earn it.

As most of you know, this company has been hammered hard by some of the St. Louis newspapers for two or three years past. They denounced our "20% profits," our "robber Keokuk contracts," our "inside grafts," our "alien landlordism," etc., etc. About the only crime they didn't accuse us of was highway robbery.

True? Not a word of it!

But it robbed us of a share of public good will which we must have if we are to give you most and best Electric Service at least cost.

So we have decided, in your interest as well as our own, to use a little printer's ink telling you the exact truth about those matters.

Beginning tomorrow we'll show you every angle of the "robber Keokuk contracts"—show you how those contracts are not a burden but a blessing to this city and county.

Perfectly good humored—no hitting back—just the facts.

On the Job 24 Hours of Every Day

One of our technical friends says these Editorials have "got on his nerves." "Your language," he says, "is not technical, and your explanations," he says, "do not deal with the fundamental principles of electrical science."

Guilty as charged. It isn't and they don't, because that wasn't our intention.

What we're trying to do is to make clear to our public the main facts about this public service institution; the work we do and the pay we get for it and why; the service our customers get and what it costs and why; the ways in which this service can be extended, improved and cheapened, and how our customers, if they see fit, can help get these results.

The Electric Era in the life of mankind has only just begun. The boys and girls now in the grammar schools are going to see developments in the scope and variety of Electric Service which older folks today can only dimly imagine. So many of the boys and girls as these informal talks may send to the books, the laboratories and the lecture rooms for knowledge of electrical science will thank us for the inspiration. Because they'll be the better equipped to get most out of life on easiest terms in the wonderful Electric Age into which humanity is just now entering.

But that's only incidental to our purpose. What we're trying to get across, to every man, woman, boy and girl in the St. Louis district, is this fact:

Union Electric is fully aware of its obligations as to kind and cost of service it must give, of its duty as a public service institution to lead the way in making St. Louis each year larger, cleaner, healthier and more prosperous, and is on the job smiling, with eyes wide open, 24 hours of every day.

TYPICAL GOOD-WILL PUBLICITY

stock at par, to its customers only, not more than $2,000 to any one buyer. The allotment was sold to 645 customers in seven business days. A second block of $500,000 was then offered under the same terms and was purchased by 747 customers in less than two weeks. This stock was bought at the offices of the company and no outside solicitation was done.

Since that time the stock has been offered and sold as requirements dictated. The plan has been broadened and enlarged until at this time there is a regular stock-selling department operating under the guidance of a manager. He has both office and outside salesmen to make the advertising program effective and maintain the continuous-selling feature of the plan.

Supplementing the work of this organization is the short competitive campaign selling carried on by other employees of the company. The competitive units are teams of from six to twenty employees operating under clearly defined rules. Commissions and prices are provided on the basis of gross sales.

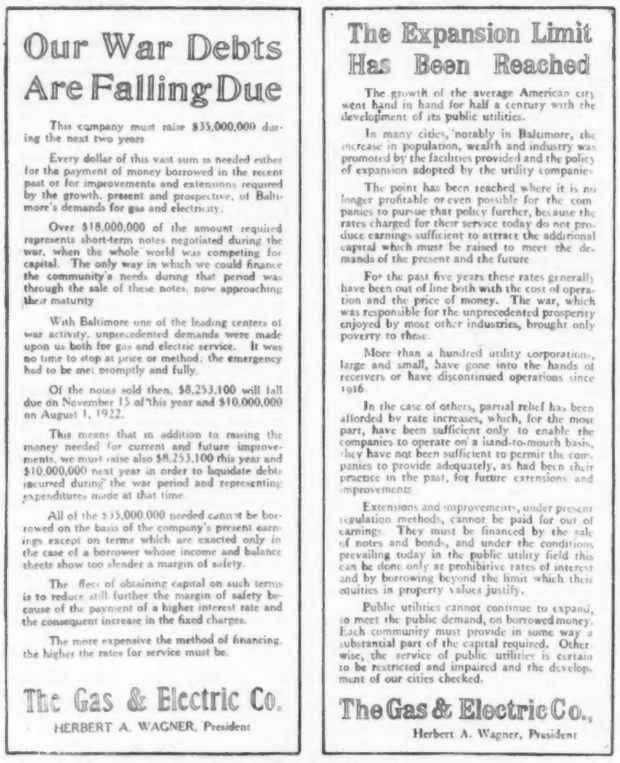
During the difficult year of 1920 a total of 13,479 shares of the stock were sold at par through all sources.

In one campaign covering sixty working days the teams sold $230,000 worth of the stock and earned commissions and bonuses of $6,886.50. Thirteen individual team members earned in excess of $100 each, and the high man gained a reward of $1,100. A window display was used in connection with this campaign and is shown in an accompanying illustration.

The company now has 4,800 home partners, and the number is growing daily. The sales of the security department continue at the normal rate after the short intensive campaigns described.

Baltimore Company Places Financial Problems Before Public

THE Consolidated Gas, Electric Light & Power Company of Baltimore has undertaken a comprehensive educational campaign bearing upon the credit problem of public utilities. It is the company's purpose to acquaint the public with the needs of public utilities in general and the Consolidated company in particular for money to provide facilities to meet the growing demand for service, the difficulties encountered in obtaining this money, and the necessity of co-operation



Our War Debts Are Falling Due

This company must raise $35,000,000 during the next two years

Every dollar of this vast sum is needed either for the payment of money borrowed in the recent past or for improvements and extensions required by the growth, present and prospective, of Baltimore's demands for gas and electricity.

Over $18,000,000 of the amount required represents short-term notes negotiated during the war, when the whole world was competing for capital. The only way in which we could finance the community's needs during that period was through the sale of these notes, now approaching their maturity

With Baltimore one of the leading centers of war activity, unprecedented demands were made upon us both for gas and electric service. It was no time to stop at price or method; the emergency had to be met promptly and fully.

Of the notes sold then, $8,253,100 will fall due on November 15 of this year and $10,000,000 on August 1, 1922.

This means that in addition to raising the money needed for current and future improvements, we must raise also $8,253,100 this year and $10,000,000 next year in order to liquidate debts incurred during the war period and representing expenditures made at that time.

All of the $35,000,000 needed cannot be borrowed on the basis of the company's present earnings except on terms which are exacted only in the case of a borrower whose income and balance sheets show too slender a margin of safety.

The effect of obtaining capital on such terms is to reduce still further the margin of safety because of the payment of a higher interest rate and the consequent increase in the fixed charges.

The more expensive the method of financing, the higher the rates for service must be.

The Gas & Electric Co.

HERBERT A. WAGNER, President

The Expansion Limit Has Been Reached

The growth of the average American city went hand in hand for half a century with the development of its public utilities.

In many cities, notably in Baltimore, the increase in population, wealth and industry was promoted by the facilities provided and the policy of expansion adopted by the utility companies

The point has been reached where it is no longer profitable or even possible for the companies to pursue that policy further, because the rates charged for their service today do not produce earnings sufficient to attract the additional capital which must be raised to meet the demands of the present and the future

For the past five years these rates generally have been out of line both with the cost of operation and the price of money. The war, which was responsible for the unprecedented prosperity enjoyed by most other industries, brought only poverty to these.

More than a hundred utility corporations, large and small, have gone into the hands of receivers or have discontinued operations since 1916.

In the case of others, partial relief has been afforded by rate increases, which, for the most part, have been sufficient only to enable the companies to operate on a hand-to-mouth basis, they have not been sufficient to permit the companies to provide adequately, as had been their practice in the past, for future extensions and improvements

Extensions and improvements, under present regulation methods, cannot be paid for out of earnings. They must be financed by the sale of notes and bonds, and under the conditions prevailing today in the public utility field this can be done only at prohibitive rates of interest and by borrowing beyond the limit which their equities in property values justify.

Public utilities cannot continue to expand, to meet the public demand, on borrowed money. Each community must provide in some way a substantial part of the capital required. Otherwise, the service of public utilities is certain to be restricted and impaired and the development of our cities checked.

The Gas & Electric Co.

Herbert A. Wagner, President

ADVERTISEMENTS DESIGNED TO EXPLAIN CLEARLY THE COMPANY'S FINANCIAL PROBLEMS

on the part of the public to enable the utility to attract new capital.

The campaign is being carried on largely through the advertising columns of the Baltimore daily newspapers, supplemented by pamphlets which are being sent to customers, bearing upon the matters under discussion, while the *Gas and Electric News*, the company's house organ, is utilized to give the 3,300 employees an intelligent understanding of the campaign.

The financial rather than the operating side of the company's problems is emphasized in its advertising copy, specimens of which are reproduced here. The company believes that the complex character of the problems involved requires that they be presented in newsy style and simple terms which the public can readily understand.

To give the personal touch desirable in advertising of this character, each advertisement carries President Herbert A. Wagner's name under the company title.

To Promote Better Merchandising of House Wiring

IN AN effort to promote better merchandising practice as applied to residential wiring a subcommittee of the N. E. L. A. wiring committee, R. S. Hale, chairman, is preparing a series of articles designed to inject into the advertising given this matter something more than the stereotyped specifications and bare statements as to terms of payment which characterize a great deal of the material that is now used. The subcommittee consists of Arthur L. Nelson, Commonwealth Edison Company, chairman; Clarence Renshaw, National Metal Molding Company, and J. C. Tillman, Consolidated Gas, Electric Light & Power Company of Baltimore.

The first article, entitled "Merchandising House Wiring," points out that neither the number of houses wired nor the thoroughness of the work is up to the desired standard. Drawing an interesting comparison of merchandising principles as applied to electrical appliances and to house wiring, and suggesting changes in the latter, the article says in part:

"The common attitude of the electrical industry toward wiring as compared with its attitude toward the sale of appliances is illustrated nicely by two advertisements which appeared recently in the newspapers of a certain city. One of these advertisements bore the heading in large letters 'Wire Your House Now' and proceeded to tell about the monthly payment plan and to give prosaic specifications as to the kinds of fixtures which would be included, etc. This advertisement, no doubt, was very interesting to people who had already decided to have their houses wired and who were wondering where to go to get it done. There was absolutely nothing, however, to convince those who had not reached such a decision that they ought to have the wiring done.

"The other advertisement was a good one. It carried the heading in fancy letters 'Oh, Boy!' and showed a man with an electric fan blowing full in his face. His hair and tie were waving vigorously, and he wore a smile of pleasure and contentment. After looking at the picture a moment or two, one could almost feel the breeze. The text then began: 'Why go to the seashore or the mountains when the mere touch of your finger will bring cooling sea breezes into your office, your bedroom or living room?'

"This advertisement, of course, was intended to sell fan motors and not wiring, but no one can use fan motors unless his house or office is wired. By the addition or the change of a very few words this bit of merchandising could have been made to sell wiring instead of, or in addition to, fans. This advertisement occupied less than one-half the space of the one previously referred to, yet I feel sure one insertion of it would have done more to persuade people to wire their homes than a week's run of the other.

"Persuading people to wire, however, is only the beginning. Having applied merchandising principles to interest prospective customers in wiring we must again apply them to persuade these purchasers to adopt the

right kind. Many contractors in quoting on wiring residences will begin in a very serious way, something like this:

"DEAR SIR: We hereby propose to furnish labor and material necessary to install wiring and switches in the two-story residence owned by you at 711 Blank Street.

"The work to be done under this contract will consist of wiring..... outlets for lights ..... outlets for single-pole switches, and ..... outlets for three-way switches as follows:

"Then follow a list of rooms and a table giving the number of ceiling, bracket, baseboard and switch outlets in each. Finally come the price and terms, and in curt, formal words a guarantee that the job will be done in a workmanlike manner, etc.

"When a proposal is presented in that manner the only thing the average householder can understand about it is the price. Regardless of how low the price may seem to the contractor, it looks high to the house owner. His first thought, therefore, is 'What are these outlets, anyhow, and why do I need so many of them?' and off the list come the baseboard receptacles and frequently some of the switches.

"If we would pause occasionally to consider the customer's viewpoint on matters of this kind, the remedy for the above situation would be obvious. There are mighty good reasons for the installation of baseboard outlets, switches and so forth, and if the contractor explains these properly in presenting his proposal, most people are glad to pay the additional cost to get them. Do you not think that if a contractor should present his proposals for house wiring on the following basis, they would almost invariably be accepted?

"DEAR MR. JONES: In wiring your residence to enable you to take full advantage of the comforts and conveniences which modern electric lights and appliances afford, we propose to arrange the outlets so that fixtures can be located as follows:

"1. *Porches.*—One ceiling outlet on front porch controlled by switch near the door in the hall, and a similar outlet on the back porch controlled by a switch in the kitchen. You will find it quite a safeguard to be able to snap on these lights and observe persons seeking admittance after dark before opening the door. Lighting the porches also makes them safer in bad weather and adds a bright, cheerful appearance when visitors are coming."

Similar explanations are given for the location and need of the outlets and switches throughout the house.

"With a proposal presented in this way," the article continues, "a man's interest is centered on the value he is to receive rather than on the price. There is no reason why electric house-wiring, if properly sold, should not yield a reasonable direct profit, as well as carrying with it future sales of lamps and appliances. The community needs the service which more wiring makes possible, and electrical contractors owe it to themselves and to the industry to apply to this branch of their business the same principles of merchandising which have proved so successful in selling appliances."

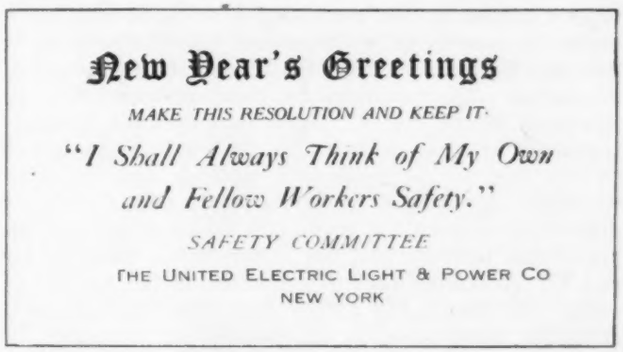
San Antonio Company Sells Stock Locally with Own Men

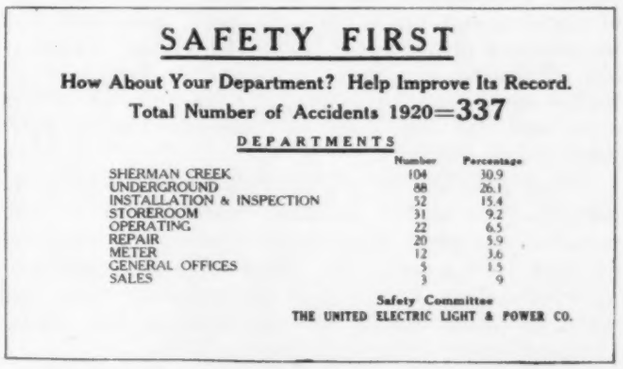
ANOTHER utility to engage in the sale of stock locally is the San Antonio (Tex.) Public Service Company, which has just placed on the market an issue of $2,000,000 in cumulative preferred stock with an 8 per cent yield. This stock is being sold principally by employees, who had disposed of approximately $80,000 worth in the first month. The company has organized an investment department in charge of S. J. Ballinger, commercial manager of the company. Just enough salesmen are kept in the investment department to take care of inquiries and insure the proper treatment. No effort is made to secure experienced stock salesmen. Employees who are familiar with the company's business and know how to be polite and courteous to the public are used as special salesmen.

Effective Method of Impressing "Safety-First" Ideas Upon Employees

ACTIVITIES in furtherance of "safety first," restricted to a large extent by important war obligations in the last few years, have been earnestly resumed by the United Electric Light & Power Company of New York. A general committee embracing every department of the company has been appointed to meet monthly, hear and consider the reports of subcommittees and devise ways and means of minimizing the so-called unavoidable, careless and all other classes of accidents by educating and instructing the company's personnel and by improving and safeguarding equipment that presents an injury hazard.

An interesting innovation intended to arouse the interest of employees in the movement and to make them think has been adopted. This is based on the utiliza-


New Year's Greetings
MAKE THIS RESOLUTION AND KEEP IT
"I Shall Always Think of My Own and Fellow Workers Safety."
SAFETY COMMITTEE
THE UNITED ELECTRIC LIGHT & POWER CO
NEW YORK



SAFETY FIRST MESSAGE INCLOSED IN PAY ENVELOPES

tion of the weekly pay envelope to convey a safety message to every employee regularly. The first notice was in the nature of a New Year's greeting from the committee and was followed up by a notice showing the number and percentage of accidents happening during a given period in the various departments of the company. Both notices are shown here. It is hoped in this way to arouse departmental pride and rivalry. The committee intends to present pictorially the results of accidents by this method and bring the consequences of carelessness forcefully to the attention of every employee.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Motors, Generators and Transformers

Temperature Limits of Large Alternators.—G. A. JUHLIN.—In considering the possibility of increasing temperature limits in alternators the author refers particularly to class B installations, including mica and asbestos, in which the maximum temperature at present allowed is 125 deg. C. Tests are described and summarized in the following table, in which is given the breakdown voltage of various classes of mica wrapped on copper bars after heating for 7,000 hours at 190 deg. C.

Description of Wraps on Various Samples	Breakdown Voltage Minimum	Maximum
Empire cloth and mica, hand-wrapped	15,000	26,000
Cambric and mica, machine-wrapped	31,000	35,000
Paper and mica, machine-wrapped	42,000	45,000
Paper and mica, machine-wrapped	47,000	48,000
Mica and shellac only, machine-wrapped	50,000	52,000

In conclusion he states that mica insulations of the type employed in the construction of up-to-date alternators is capable of withstanding temperatures up to 200 deg. C. without losing its electrical or mechanical properties. The maximum temperatures could then be increased to 160 deg. C., based on embedded temperature-detector measurements for the stator winding and on the increase or resistance methods for the rotor winding. Allowing a correction of 10 deg. C. for the difference between the maximum temperature and the observable temperature, the latter would then be 150 deg. C. Assuming that no reduction in the margin of safety will result, the author says that there are considerable advantages to be obtained by adopting the higher temperature limits, namely: (a) In the case of machines running at the same speed, those with high temperature rating are cheaper, (b) higher efficiencies are obtainable, (c) larger units can be built, or (d) higher speeds can be adopted for machines of certain sizes, and (e) less space is required.—London *Electrician*, Jan. 28, 1921.

Vector Diagram for Salient-Pole Alternators.—E. B. SHAND.—The author proposes modifications in constructing the vector diagram for synchronous machines to take into account the effect of salient-pole construction. This, it is said, is of particular importance when operating synchronous machines at low excitations.—*Electric Journal*, February, 1921.

Lamps and Lighting

Flashing Speeds of Incandescent Signal Lamps.—A. G. WORTHING.—A study of the theory of signaling with incandescent lamps for the development of a unit for use in daylight. These conclusions are reached: (1) The time required for a filament to heat to approximately its maximum brightness exceeds greatly the time required in cooling to effectively zero brightness; (2) the higher the maximum temperature of a flash the greater the speed of the flash; (3) the smaller the filament the greater is the speed of the flash; (4) the less the resistance in a circuit external to a flashing tungsten lamp the greater is the speed of the flash; (5) the speed of flashing for a given filament at a given temperature in various atmospheres—including a vacuum—is greater the greater the gas loss; (6) for lamps of the same open-filament construction, the same luminous flux and the same average life at a fixed voltage the speed of flashing is greater the greater the gas loss. Both carbon and tungsten filament lamps were tested, also lamps with ribbon and wire filaments. Regarding ribbon filaments it is said that the quantity of material in a ribbon filament being less than in an equivalent wire filament it may be possible by going from a wire filament to a ribbon filament in gas-filled lamps to obtain either a considerable increase in signaling speed, or, without a reduction in speed, a higher efficiency through choosing an atmosphere involving a decreased gas loss.—*Journal*, Franklin Institute, February, 1921.

Generation, Transmission and Distribution

Voltage-Regulating Systems of Synchronous Converters.—F. T. HAGUE.—The writer deals with the origin of the booster-type converter, giving its development into the type now extensively used. Another well-known scheme is inherent regulation resulting from the out-of-phase or wattless current flowing through a reactor. This method has found extensive application in the railway field. The split-pole converter is also described, and it is said that owing to the complicated magnetic structure of a split-pole converter it is not practicable to make an ideal application of commutating poles that are inherently self-adjusting, while with the booster-type converter the addition of commutating poles presents no difficulties. A discussion follows showing how these types of converters meet operating conditions.—*Electric Journal*, February, 1921.

Utilizing Energy Accumulators in Connection with Hydraulic Power Stations.— DELLA RICCIA.— Most energy accumulators have a rather low efficiency. However, when used in connection with a hydraulic power plant with insufficient hydraulic regulation facilities even a poor energy accumulator may prove economical by making it possible to utilize much water power that is otherwise going to waste during off-peak hours. On the basis of this reasoning the author has investigated the economy of energy storage by a graphical method utilizing so-called monotone diagrams or symbolic load curves. In studying two practical cases, corresponding to an equivalent time of 1,860 hours and 4,060 hours a year (lighting and traction respectively), he found that the installation of an energy accumulator with a return efficiency of only 30 per cent makes it possible to increase the annual output of the station by 100 per cent in the first case and by 53 per cent in the second case. If the hydraulic station is co-operating with a thermal peak-load station and the energy accumulators are so proportioned as to reduce by 50 per cent the output of the thermal station on that day of the year when

the energy demand is at maximum, then, by virtue of the energy accumulator, the coal consumption is cut to a third in the 1,860-hour case, and in the 4,060-hour case it is cut in half. In concluding the author describes a thermal energy accumulator invented by C. del Proposto. In his device the surplus hydro-electric energy is used to heat oil to a very high boiling point. During peak-load hours the hot oil is pumped through a system of tube coils placed in big water tanks, so-called fireless boilers, and the stored heat is used for generating steam. The steam is superheated in another coil system, submerged in the hot-oil container and fed into the steam turbines of the peak station.—*Revue Générale de l'Electricité*, Oct. 23, 1920.

Coal Handling in the Power House.—GEORGE FREDERICK ZIMMER.—It is shown that the provision of one conveyor of the gravity-bucket type answers all or a number of handling purposes for many coal-handling and storage installations for power houses.—London *Electrician*, Dec. 31, 1920.

Traction

Development of Electric Trucks of the Hansa-Lloyd Works at Bremen.—The city of Bremen in 1906 introduced into its service several small electric trucks which were operated by two motors of 2 hp. to 5 hp. each, driving by single gears the two front wheels. These little tractors operated very well and some of them are still running after fourteen years of service. The desire of a higher electrical efficiency brought about the development of two new types—a 5-ton truck and a load tractor of 5 tons to 10 tons, both equipped with but one motor. Their drive is made with differential and side chains. The tractor replaces three heavy horse teams or eighteen ox teams. Including all expenses and the wages of the driver the operating expense per kilometer run is only 5½ marks. A further development of the Hansa-Lloyd works was a "unity electric driver"—a battery above two (front) wheels, driven by one motor. This front unit may be combined with a great variety of utility vehicles.—*Elektrische Kraftbetriebe und Bahnen*, Jan. 24, 1921.

Installations, Systems and Appliances

Electrode Holders for Metallic Arc Welding—L. W. WEBB.—The essential requisites for electrode holders are discussed, pointing out principal defects to be avoided. It is said that rational design and good materials should be employed regardless of cost.—*Power*, Jan. 25, 1921.

Cotton Spinning Mills.—L. MILLER.—In considering the type of drives for cotton spinning mills it is said that the following characteristics are most desirable: (1) Maximum production combined with uniform quality of product; (2) uniform speed without cyclical variations; (3) freedom from breakdown and ease of repair; (4) cleanliness and good lighting; (5) sectional working without loss due to running shafting light; (6) general convenience in layout of mill and in carrying out extensions.—*Beama* (London), January, 1921.

New Form of Section Drive for Paper Machines.—W. W. CRONKHITE, W. L. MERRILL and H. W. ROGERS.—The shortage of newsprint is said to have created a demand for high-speed paper machines. Several types of sectionalized electric drive have been offered for the consideration of the paper manufacturer in which some form of special governor is incorporated which cannot act until a change in speed has actually occurred. In other words, an undesirable condition must have happened before it can be corrected, and there is always a possibility of breaking the sheet before the governor functions. A new sectionalized electric drive is said to have been developed which prevents a change in speed taking place and is not subject to the difficulties mentioned above.—*General Electric Review*, January, 1921.

Electrophysics and Magnetism

An Electromagnetic Theory of Gravitation.—H. A. WILSON.—An electric system in a medium whose specific inductive capacity k varies from point to point tends to move in the direction of increasing k. It is suggested that if we assume the specific inductive capacity of the ether to vary near matter, gravitation may be explained as a result of this tendency. In a medium in which, at a distance r from a mass m, $k = 1 + m/r$, it is shown that a rigid electrostatic system would be acted on by a force directed toward m and equal to mm'/r^2, where m' is the electromagnetic mass of the system. But in order to explain the observed deflection of light by the sun we must have $k = 1 + 2m/r$; and this will not give the force mm'/r^2 unless the system contracts in the ratio of $1 : 1 - m/r$. A physical explanation of this assumed contraction is suggested. If the system with the mass m' is also supposed to modify k, it is necessary to take into account the energy changes in m and in the ether. The effect of gravitation on the frequency of the light emitted by an atom, which was predicted by Einstein, can be easily deduced from the present theory.—*Physical Review*, January, 1921.

Units, Measurements and Instruments

New Form of Standard Cell.—C. J. RODMAN and T. SPOONER.—A form of portable standard cell has been developed for which advantages are stated as follows: (1) Compactness; (2) the cathode is centrally located, holding the mercury in a central chamber; (3) stability of construction; (4) legs are kept at the same temperature, thus reducing emf. variations; (5) constant electromotive force is obtained over long periods of time.—*Electric Journal*, February, 1921.

Wireless Valve Circuits as Applied to the Measurements of Physical Quantities.—R. WHIDDINGTON.—The application of electron valves to the measurement of minute distances is described. It is said that it is possible to detect a distance as small as one two-hundred-millionth of an inch with apparatus that is fairly manageable.—*Wireless World*, Jan. 22, 1921.

Telegraphy Telephony and Signals

Wired Wireless Transmission.—PHILIP R. COURSEY.—The author likens this system to a case of ordinary radio transmission with an ideally perfect directive sending aërial. Receiving stations in other directions will under these conditions hear nothing of the signals passing between the two stations concerned. One advantage of such radio transmission is that in case of a leaky line or one in poor condition it will still be usable for radio transmission. Practical details of sending and receiving apparatus for such systems is described.—*Wireless World*, Jan. 8, 1921.

Output of Ringing Machines for Automatic Telephone Exchanges.—F. P. DUMJOHN.—A formula is offered for the output of the ringing machines providing for a maximum number of simultaneous demands at full-load voltage and frequency.—*Post Office Electrical Engineers' Journal*, London, January, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Action on Colorado River Permit Suspended Pending Investigation

THE Federal Power Commission has deemed it desirable to suspend further action on the application of the Southern California Edison Company for a license to undertake a development on the Colorado River in order that a more general investigation of the possibilities may be made. If this is done, it will mean that the possibilities of irrigation as well as the opportunty for power development will receive full attention before any single project is approved by the commission. This idea is in line with the legislation proposed by Senator Pittman at the last session of Congress, at which time he recommended that the several interested states, the Reclamation Service and the Federal Power Commission should jointly investigate the Colorado River from all important points of view.

It had been rumored that the commission suspended action on this application because state permits had not been obtained by the company. O. C. Merrill, executive officer of the commission, says that this is not so. It is considered essential, however, to wait to determine a general policy with regard to so important a river so that no single project which might now be approved will later be found a stumbling block in the general program most desirable for all interested communities.

N. E. L. A. Convention to Emphasize Management Topics

EMPHASIS will be placed at the coming convention of the National Electric Light Association at Chicago, May 31 to June 3, on public utility finance, service, public relations and regulation. In speaking of the program to an ELECTRICAL WORLD representative M. H. Aylesworth, executive manager of the association said:

"While it is, of course, too early to give out any details of the program, still the indications are that it will be unusually interesting this year. Never in the history of the electrical industry has there been such a demand for discussion and solution of vital problems which are inseparably connected with the national progress in industrial and home-building development.

"Among the guests of honor will be state public utility commissioners from different parts of the country, federal, state and municipal officials, as well as many of the leading bankers, manufacturers, jobbers and contractor-dealers.

"Among the most important addresses and discussions which will take place will be those dealing with finance, service, public relations and regulation. The national committee on water power will have an interesting report dealing with its many conferences with and appearances before the Federal Power Commission. The other national committees, including that on steam-railroad electrification, will also have very interesting reports.

"The national Technical, Commercial and Accounting Sections will hold section meetings throughout the convention as usual, while the proceedings of the Public Relations Section, which is composed of executives, will be merged with the general morning sessions.

"Advance applications for reservations indicate a record attendance of company executives and members of their organizations."

Muscle Shoals Work Suspended Following Congressional Action

IMMEDIATELY following the action of Congress in refusing to appropriate further for the Wilson Dam at Muscle Shoals telegrams were sent by the chief of engineers suspending all work which could be abandoned at this time without jeopardy. At Jackson Island the work will be continued until the cofferdam can be removed. By carrying forward for a few weeks more the work on the south abutment an important saving will be made. By suspending the work promptly it will be possible to keep on hand about $1,000,000 of the existing appropriation, which will be sufficient to look after maintenance work until August, 1922, the earliest date that any further appropriation probably will be made available.

Those favoring the continuance of the work on the dam at Muscle Shoals carried the fight for the ten-million-dollar appropriation into the closing hours of Congress. When the House voted a second time to maintain its stand that no appropriation for the project should be made it became evident that a continuation of the fight in the Senate could result only in the failure of the sundry civil bill.

Relation of Public to Utility Regulation

A PUBLIC utility regulation must be prompt, fearless and intelligent. This was the message of Campbell Russell, chairman of the Oklahoma Corporation Commission, to the Oklahoma Utilities Association, which met in convention in Oklahoma City on Tuesday to Thursday of this week. Mr. Russell said that the best public protection is a well-protected public utility and that the passage of the measures before the Oklahoma Legislature to curtail the powers of the present Corporation Commission would be the worst move that could be made and would lead eventually to the enactment of a more stringent and possibly more radical commission law. Returns should be based on the efficiency of management, and, he asserted, unless this principle is followed in commission regulation municipal ownership had best come at once.

Paul A. Walker, referee of the Supreme Court of Oklahoma, discussed the power and duties of the

Oklahoma Supreme Court in rate and service cases. C. J. Griffith of the Little Rock Railway & Light Company discussed the "rise and fall" of the Arkansas Corporation Commission, its present status being due, he said, to a combination of ill-considered actions on the part of some utility interests that antagonized the people of the state and to a political situation in which the utilities were not involved.

These two papers brought out a lively discussion of the problem of public utility publicity in which the opinion was voiced by several speakers that most of the publicity material that has been used has gone far wide of the mark because it did not present the problems in a manner that was of interest to the general public.

The criticism that was made was that the material appeals primarily to the banker and business man and that the large body of citizens whose support must be secured before the banker and business man could act were not reached at all. In the discussion President Shartel insisted that utilities and the public generally had failed to recognize the fact that the fundamental economic basis of the utility business was in no wise different from that of any commercial venture. Until this fact is realized, he said, there can be little progress made in clearing up the present difficulties.

Accident prevention was discussed by J. Smith Speed of Oklahoma City on Tuesday afternoon. Natural-gas and street-railway problems were also discussed, as the association is made up of all the utilities in the state. The annual banquet was held on Tuesday evening, and on Thursday the various division meetings at which the individual utility problems were discussed were held. The following officers were elected for the coming year: President, John W. Shartel; first vice-president, C. E. Devin; second vice-president, F. A. Willard; manager, H. A. Lane.

Timely Program for Eastern Jobbers' Meeting on March 15

FOR the regular quarterly meeting of the Atlantic Division of the Electrical Supply Jobbers' Association, which will be held March 15 at the Hotel Commodore in New York, an interesting and timely program is being arranged. Among topics to come before the meeting is the necessity of jobbers' maintaining stocks for service under all conditions. W. I. Bickford of the Iron City Electric Company, Pittsburgh, will lead the discussion of this subject. E. Donald Tolles, secretary of the association, will report upon his investigations of systems employed by jobbing houses in their receiving, shipping and charging departments. These investigations have been made with a view to ascertaining if it would be possible to formulate a uniform system of handling orders for use by electrical supply jobbers.

"How to Sell the Contractors" is the subject of an address to be given by Charles L. Eidlitz, president of R. B. Corey & Company, New York. In this address Mr. Eidlitz, from his personal experience as contractor, as manufacturer and as jobber, will take up the question of why contractors are prompted to do business with the manufacturers instead of the jobbers. William L. Goodwin, who recently became associated with the Society for Electrical Development, will deliver a message from the society.

There will also be an executive session of the Atlantic Division, at which time members will consider the advisability of modifying the requirements for membership to admit smaller jobbers. At the same meeting there will be an election of a new division chairman to serve out the unexpired term of A. M. Little of Syracuse, resigned.

A. I. E. E. Telephone Interference Rules Withdrawn After Misuse

APPROVAL of the A. I. E. E. rules on telephone inductive interference has been withdrawn by the board of directors of the Institute as the result of a protest by the National Electric Light Association. The "telephone interference factor" had been misused in the Homer Electric Light & Power Company's case before the Illinois Public Utilities Commission (ELECTRICAL WORLD, Feb. 5, page 336).

In addition to the rule on "telephone interference factor" definitions of the following terms have been withdrawn: "Generation noise," "commutation noise," "interference," "inductive interference," "leakage telephone interference" and "telephone receiver." The rules have been referred back to the standards committee of the Institute for further consideration and report.

Interest Shown in $25,000,000 Project on Columbia River

REMARKABLE interest has been manifested in the proposal to harness the Columbia River at Umatilla Rapids, which involves an ultimate outlay of $25,000,000 and necessitates joint co-operation by two states —Oregon and Washington. The project would develop 120,000 continuous horsepower and 200,000 horsepower during the irrigation season. The keen interest shown by railroad interests indicates that the transcontinental lines may have an eye on this project as a means of providing power for the electrification of lines east of the Cascade Mountains which now compete with the Chicago, Milwaukee & St. Paul's electrically equipped road.

Members of the legislatures of Oregon and Washington, representatives of railroads, business men of both states and city and county officials recently met at Walla Walla to discuss the possibility of developing the remarkable power available at Umatilla Rapids.

New Shawinigan Water & Power Issue Offered to Yield 6¾ per Cent

ANNOUNCEMENT was made this week of a new issue of $2,500,000 Shawinigan Water & Power Company first refunding sinking-fund 6 per cent bonds, due July 1, 1950, at 90½ and interest, yielding 6¾ per cent.

This yield is lower than that of any other utility security that has been placed on the market recently, and with two exceptions the return to the investor of 6¾ per cent is less than that of any new public utility security that has been publicly offered within the past twelve months.

Proceeds from the sale of these bonds, it is stated, will be sufficient to pay all present floating debt of the company and to provide for new construction.

Rhode Island Organizes Electrical Co-operative League

REPRESENTATIVES of the electrical industry in Rhode Island met at the Providence Chamber of Commerce Feb. 16 and organized the Rhode Island Electrical League for the purpose of securing co-operative development of electrical trade and interests in the state. Arthur B. Lisle, general manager Narragansett Electric Lighting Company, Providence, and a director of the chamber, presided. The following speakers contributed to the discussion of the opportunities for a comprehensive development of electrical affairs through appropriate organization: Robert W. Adams, General Electric Company; W. A. Huse, W. A. Huse & Son; F. W. Bliss, General Electric Company; E. L. Milliken, Blackstone Valley Gas & Electric Company, a Stone & Webster property; L. L. Levine, Belcher & Loomis; M. F. Falk, Union Electric Supply Company, and F. A. Gallagher, Jr., Narragansett Electric Lighting Company.

M. F. Falk was elected permanent chairman and F. A. Gallagher, Jr., secretary. Thirty-seven representatives from various branches of the industry were present, and the following committees were appointed: Advisory committee, A. B. Lisle, H. O. Phillips, A. W. Marcou, R. W. Adams, W. E. Sprackling and G. Rogers; working committee, M. E. Learned, A. H. Allcott, H. J. Pettingell, L. C. Crandall, F. A. Boss, W. M. Wilson, Albert Walker and G. Schneider. A co-operative advertising campaign will be launched shortly.

Turbo-Generator Electric Drive Proved Successful in Sea Trial of Freighter

ELECTRIC drive on the freight ship *Invincible* was pronounced successful after an eight-hour sea trial in and around New York harbor on March 5 under observance of the United States Shipping Board. The boat is intended for transoceanic service and has a displacement of 7,880 gross tons and 4,960 net tons. Power is supplied by a turbo-generator to a 3,000-hp. induction motor, both made by the General Electric Company. The electrical equipment was installed at the Tebo Yacht Basin plant (Brooklyn, N. Y.) of the Clark Shipyard Corporation. The ship will be operated by the Cosmopolitan Shipping Company.

Diesel-Engine Electric Drive for Ocean-Going Freight Ship

THE first ocean-going freighter in the United States to be equipped for Diesel-oil-engine electric drive will result from contracts just signed between the Todd Shipyards Corporation and the American Mediterranean Steamship Company calling for the conversion of the motorship *Fordonian*, a 2,200-ton vessel. More than usual significance is attached to this contract as pointing the way to the adoption of a new method of ship propulsion which, with the exception of a fishing trawler, has never been commercially adopted in this country before.

The *Fordonian* is a single-screw freighter 257 ft. long, 42-ft. beam, 26-ft. draft, with a dead weight tonnage of 2,200 tons. Her new equipment will consist of twin Ausaldo San Giorgic two-cycle, four-cylinder Diesel engines directly connected to two 240-kw., 250-volt, 200-r.p.m. compound-wound direct-current generators. The generators will furnish power to a double armature, pedestal-mounted, 850-b.hp. 120-r.p.m. motor, which will be directly coupled to the propeller shaft.

The control system will be of the same type as that installed in the Diesel electric trawler *Mariner*, with the exception that the pilot house control is omitted on the *Fordonian*. This control apparatus consists of a panel board, meters, switches, rheostats and protective relay for the propeller motor, grid resistors which form a starting rheostat, and control contactors. This group of contactors contains those for staring, stopping and reversing the propeller motor, and are operated by a master controller in the engine room. While they are normally magnetically operated, there is also a provision for manual operation in case of emergency. The electrical apparatus contract has been awarded to the General Electric Company.

Financial Plans of California Companies

APPLICATIONS are pending before the California Railroad Commission for approval of extensive financial plans prepared by two large electric systems. The California-Oregon Power Company desires to reduce its outstanding securities by $6,062,000. Its plan includes the organization of a new company which will issue $10,000,000 of bonds to pay for necessary extensions and to meet underlying bond issues as they mature. The San Joaquin Light & Power Corporation wishes to issue $7,000,000 in bonds. Of this $2,625,000 would be used to meet construction costs resulting from development work on the company's Kern Canyon power project and the steam plant at Buttonwillow. Among the immediate improvements contemplated are an 8,250-hp. unit at the Kern River plant, to cost approximately $857,000, and the addition of a 17,000-hp. unit to the plant at Buttonwillow, estimated to cost $1,654,850.

Elimination of Waste Great Opportunity for Engineers

DUPLICATION of effort, lack of co-operation in research work, disregard of standard design, inefficient utilization of power and transportation and defective methods in technical educational institutions are the chief causes of the waste occurring in our industrial activities today, declared L. W. Wallace, executive secretary of the American Engineering Federation, in an address, "Waste and the Engineer," before a conference of engineers and economists in New York on March 9.

The duty of the engineer, Mr. Wallace pointed out, is to devise and recommend ways of eliminating waste, but the best results cannot be hoped for until the technical schools operate at a higher efficiency by doing away with the present large percentage of idle time of both instructors and students.

Along the lines of scientific and industrial research much information that is of great value is already known but has not been made available to the general public. This, together with the vast amount of duplication of work, causes enormous losses annually.

In the utilization of power, Mr. Wallace said, great strides of increased efficiency have been made in recent years, especially during the war, and present indications are that still greater economies are soon to be effected. Closely related are the transportation problems, both

internal and external, for which means of solution in some cases are already available. An example of possible savings through adoption of modern apparatus was given of a railroad which installed industrial trucks in its freight terminal at a cost of $63,000. During the first year's operation of these trucks a saving of $51,000 was realized.

In conclusion, Mr. Wallace emphasized the importance of co-operation and co-ordination of effort by all industries and recommended that greater power and authority be conferred upon the engineer in order that his work may be more productive of results.

Worcester Company Reduces Power Rates

A REDUCTION in power rates went into effect March 1 on the system of the Worcester (Mass.) Electric Light Company, affecting about 1,200 power customers. This follows a reduction of lighting rates of from 9 to 8 cents per kw.-hr. which affected 20,000 customers. The new power rate is figured on a recent coal quotation of $8.60 per ton, although the company's present fuel supply represents an average cost of $10.54 per ton. The reduction effected by the application of the coal clause differential to the lower price quoted reduces the bills of power customers from 5 to 16 per cent according to their individual energy rates, which vary from 6 to 2 cents per kw.-hr., depending on the energy consumed. The company has received many expressions of appreciation from its customers.

Last N. E. L. A. Executive Committee Meeting of the Year to Be Held Tuesday

THE last N. E. L. A. executive committee meeting before the annual convention in May will be held Tuesday of next week at the Edison Building in Chicago, when there will be present representatives from all of the thirteen geographic divisions and the chairmen of all of the sections. Among those expected to attend this meeting from the Pacific Coast is Past-president R. S. Ballard.

Among the important subjects will be reports from the national section chairmen on the year's activities and a report on the association's national work, such as the good-will advertising and the work on public utility information. The manufacturers' committee on good-will advertising will also make a report.

Investment Department of Northern Illinois Company Proved Success

THE investment department established by the Public Service Company of Northern Illinois a year ago was successful in selling all of the 23,280 shares of preferred stock offered for sale to the company's customers. This accomplishment, the annual report of the company for 1920, just issued by President Samuel Insull, says, increased the number of stockholders by about 2,000, and when all the stock which has been subscribed for on the installment plan shall have been fully paid for the total number of stockholders will be approximately 13,000, as compared with 2,455 before the investment department began work. During the year the company received $1,341,020 from this sale of preferred stock, also selling $1,750,000 of 6 per cent three-year gold notes and $1,000,000 of 8 per cent ten-year gold notes. Operating revenues from electricity, gas, heating and water showed an increase over 1919 of $2,328,861, and 10,000 electrical customers were added.

In 1920 the company made only such extensions and additions to its system as were necessary to meet growing demands. The connecting of large power customers necessitated building several transmission lines. One of them was the 33,000-volt, three-phase line, 12 miles long, between the Blue Island generating station and Chicago Heights, which was put in service in the fall. Another was the 12,000-volt, three-phase underground extension from the city limits of Chicago to the National Malleable Castings Company in Cicero. The company also built a 12,000-volt, three-phase transmission line from the city limits of Chicago to the Evanston substation and raised the voltage of the transmission line connecting Crystal Lake with the Waukegan generating station from 20,000 to 33,000. New 12,000-volt underground cables are now being laid in the village of Oak Park, and in Chicago Heights the company is installing a 500-amp., 4,000-volt, three-phase feeder connecting the Calumet Steel Company with the new Chicago Heights substation.

Summary of Federal Power Commission's Work to March 4

FOLLOWING is an official summary of the work done by the Federal Power Commission from its organization up to the close of Congress on March 4, when a change in the membership of the commission automatically took place with the transfer of the portfolios of War, Agriculture and the Interior:

Number of applications received	178
Number withdrawn	4
Combinations of applications	2
Total effective applications	172
Number of complete applications	70
Number of applications advertised	84
Number on which advertisement has expired	34
Number of cases for which General Land Office has been requested to make land withdrawals	49
Number submitted to Departments of War, Interior and Agriculture for field report	68
Number on which field report has been received	14
Number of applications before this office for final action	25
Number acted upon	23
Number on which action is pending	2
Applications in conflict	57
Applications the Reclamation Service has asked to have held up pending joint study	17
Declarations of intention filed with the commission:	
Number received	5
Number complete	5
Number submitted for field report	5
Number on which report received	3
Number acted upon	3
Applications for restoration to entry of lands in power-site reserve under the provisions of Section 24 of the act:	
Number received	33
Number on which the Geological Survey has been requested to make a report	27
Number on which report has been received	2
Number acted on by the commission	6

Navy Makes New Long-Distance Radio Record

ALL previous records for long-distance radio transmission were broken this week, it is reported, from the Goat Island wireless station at San Francisco when the United States Navy sent messages within three minutes from Cavite, Philippine Islands, to Washington, D. C., a distance of 10,000 miles. The Cavite station sent the messages 7,000 miles to Goat Island, whence they were forwarded to San Diego and on to Washington.

It is reported that a new automatic control used in making this record eliminates all handling of messages between originating and receiving points.

Interconnection to Receive Attention of Ohio Operators

INTERCONNECTION of transmission lines is to be discussed at the meeting of the transmission and distribution committee of the Ohio Electric Light Association to be held at the Engineers' Club in Youngstown, Ohio, on March 17. J. C. Damon of the West Penn Power Company will discuss "Advantages and Disadvantages—When Does Interconnection Pay?" while the "Limitations of Interconnection" will be discussed by E. C. Stone of the Duquesne Light Company. A paper on load dispatching will be presented by T. J. Williams, chief load dispatcher of the Windsor power plant. An inspection trip to the Lowellville power plant will be a feature of the afternoon program.

A. C. Bedford Praises Open Conduct of Electrical Utilities

BEFORE the New England Geographic Division of the National Electric Light Association at Providence, R. I., on Feb. 24, Alfred C. Bedford, president Standard Oil Company of New Jersey, commended the frank and open methods of electric utilities in their conduct of affairs and expressed the wish that the interchange of experiences, costs and other information prevalent in the electrical field might become the practice in other industries. The importance of telling the electric utility story to the public in clear-cut fashion was emphasized by the speaker, who also took occasion to praise developments in the employee-representation principle and the participation of employees in the ownership of securities of the corporate organizations to which they belong. Mr. Bedford recounted his early connection with high-tension line development for the Portland (Ore.) company and expressed his pleasure at still being concerned in the affairs of a few electric utilities.

Bowen Tufts, president of the New England Division, called the meeting to order, about 160 representatives of various branches of the industry having assembled at the Narragansett Hotel for luncheon after an inspection trip through the South Street generating station of the Narragansett Electric Lighting Company and the electric shop of that organization.

Bill to Increase Powers of Rhode Island Commission

AT THE PRESENT session of the Rhode Island Legislature a bill is under consideration by the judiciary committee providing for the enlargement of the powers of the Rhode Island Public Utilities Commission to include regulative authority over the issuance of stock, bonds, notes and other evidences of indebtedness payable more than twelve months after their date for the purpose of meeting the cost of acquiring property necessary for utility service, conducting business, improving or constructing plant, maintaining or improving service or refunding outstanding indebtedness or securities issued for any such purpose. Public hearing is required before the commission can issue a decision on such matters; full exhibits of outlays for these purposes in stock issues are required, and in the face of additional stock issues new shares must be offered proportionately to the stockholders at such reasonable price not less than the par value thereof as shall have been determined by the stockholders and approved by the commission. It is understood that the bill as filed represents the viewpoint of the city of Providence and that a hearing will be held later at which the utility companies of the state will have an opportunity to suggest modifications.

Plan to Make Standby Plants Profit Producers

NEGOTIATIONS are under way between the American Gas & Electric Company officials and the city of Bucyrus, Ohio, for the use of the local plant of the Bucyrus Gas & Electric Company as a central heating plant under a service-at-cost plan. The city of Bucyrus is served with electricity from the transmission lines of the Ohio Power Company, and the Bucyrus plant is held merely for standby service.

The plan now being considered for Bucyrus would use the local plant for generating purposes throughout the heating season, feeding energy back into the system. The exhaust steam would be sent through a condenser, thereby producing hot water which would be piped to customers under a service-at-cost rate. Under the proposed plan the company would credit to the heating account all of the energy generated at the system cost, thereby reducing the heating cost.

Under this plan a standby plant would be a revenue producer, instead of being idle most of the time, and could be run at a profit to the company. It was stated at the offices of the American Gas & Electric Company, the parent company, that it is considering doing the same thing with two or three other similar standby plants.

Bell Telephone Service in 1921 to Be Best Yet, President Thayer Says

SO RAPIDLY has restoration of the telephone service to pre-war standards proceeded, according to the annual report of the American Telephone & Telegraph Company, issued last Saturday over the signature of President H. B. Thayer, that there are good reasons to believe that during 1921 the Bell system will give the best and most uniform service it has ever given.

For the whole Bell system, with all duplications excluded, the total gross income for the year was $85,264,976, from which more than $37,000,000 was paid in interest, rent and miscellaneous deductions from income and approximately $40,000,000 in dividends. The surplus earnings for the year were $7,785,486.

The capital stock, bonds and notes payable of the Bell system outstanding in the hands of the public at the close of the year 1920 were $1,107,417,623, while the book cost of the net assets devoted to earning a return on these outstanding securities amounted to over $1,551,000,000. Actual appraisals of the telephone plant in the Bell system made by regulatory bodies for rate-fixing purposes show that the true value of its property greatly exceeds this book cost.

The report contends that for rate-making purposes the value of the property itself and not the issued capital should be the basis of fixing the amount of the return, since otherwise conservative capitalization is penalized and a premium put upon overcapitalization

and stock watering. Mr. Thayer points out that the market value of money at the present time establishes 8 or 10 per cent as a fair return on the value of the investment, and that a return of 8 per cent on the investment of the associated companies as a whole would warrant 10 per cent dividends because the companies' assets so far exceed their capital stock. At present none of the associated companies pays more than 8 per cent dividends.

In commenting upon the upward revisions of rates that state commissions permitted many of the operating companies to make in order to meet the increased demands for telephone service, the report states that in every case there was little or no opposition on the part of the public to the increase granted. This is taken as evidence of the general realization that good and adequate service is a matter of first importance and that giving needed relief to utilities has public support. The report recommends that in order to keep the commissions constantly informed as to the requirements of the public and the problems of the utilities, and to enable them to act more promptly on rate questions, they should be provided with additional clerical and technical help.

Utility Information Bureau Planned for New York State

PLANS are being formulated by the publicity committee of the Empire State Gas & Electric Association to establish a public utility information bureau to handle publicity for member companies. It is expected that the work of this bureau will follow closely along the lines of the publicity bureaus which have been operating successfully in Illinois, Indiana and Ohio.

Horace L. Mann, chairman of the publicity committee, in his report to the executive committee of the association stated that the gross revenue of the gas and electric companies which might be expected to participate in the publicity campaign was approximately $120,000,000, and that the estimated cost would be approximately $30,000—being in the ratio of one-fortieth of 1 per cent. No definite statement has been received as yet from the Electric Street Railway Association as to whether or not it will participate if the bureau is created.

Kansas Passes Non-Par Stock Law

AN ACT providing a non-par value for stock of all new companies, including utilities, incorporated in the state has just been passed by the Kansas Legislature and signed by Governor Allen. While this will not affect the stock of corporations already formed, it will be possible under the bill for electric light and power companies, through a reorganization, to place existing stock on a non-par basis.

Another bill also has been passed by the Kansas Legislature creating the Kansas State Utilities Commission, which removes utilities from the jurisdiction of the Kansas Court of Industrial Relations. The new commission will be composed of three members entirely separate from the industrial court, which will now be free to devote its attention to labor and industrial problems.

Another bill affecting public utilities in Kansas and which has passed both houses of the Legislature and awaits the Governor's signature is an act increasing the possible life of a franchise from twenty years to thirty-five years. Heretofore the Kansas law prohibited either the State or a municipality from issuing any franchise of more than twenty years' duration.

Municipal Utilities of Washington May Be Put Under Commission Control

TACOMA and other cities in the State of Washington are seeking legislative authority to sell electric energy outside city limits. The enactment desired is in part opposed by the Stone & Webster interests in the state, and attorneys for these interests have drafted three amendments which the Legislature is to consider. These amendments provide, (1) that a city selling power outside its corporate limits would be required to pay a tax of 5 per cent on its gross receipts, both inside and outside the city, into the state treasury; (2) that such a city would be required to obtain from the Director of Public Works, who is to take over the present duties of the State Public Service Commission under the new administrative code, a certificate of necessity before making an extension or to allow it to maintain and operate outside its limits any service where another corporation is already serving the public, with the exception of places where city service is now being given, and (3) that any municipality selling or buying energy outside its limits would have to submit to the control of the Director of Public Works.

New 200,000-Kw. Steam-Electric Plant for Chicago Territory

DETAILS of the projected construction of a plant at Waukegan, Ill., to have an ultimate rating of 200,000 kw., have been announced by the Public Service Company of Northern Illinois. This plant will be tied in with the Commonwealth Edison system, and with the Calumet plant now under construction in the southern part of Chicago by the Commonwealth Edison Company it will form an additional link in the tremendous system centering in Chicago. The new plant will be just north of Waukegan on a ninety-acre tract of land fronting on Lake Michigan, and it is expected that between $4,000,000 and $5,000,000 will be spent on the first two units of 30,000 kva. each. These will be in operation some time in 1921.

The announcement of the construction of this new plant has brought out a discussion of an interconnection of systems that will involve Minneapolis, St. Paul, Milwaukee, Chicago, Keokuk, St. Louis and Louisville. The construction of approximately 100 miles of transmission line in the territory between Chicago and Minneapolis and St. Paul would tie all these properties together with transmission lines. The majority of the lines, particularly in Illinois, will be of 33,000 volts, so that much trunk-line construction will be necessary to make effective interconnection of the systems possible.

Transmission voltages of 60,000 volts to 110,000 volts already exist around Minneapolis and St. Paul, at Milwaukee and between Keokuk and St. Louis. The discussion of interconnection is interesting because of the revelation of interconnection possibilities in the territory and the fact that physical connection of the electric light and power companies in the territory has progressed so far.

Light and Power Industry Is Community's Heart, Says S. W. Childs

INSTANCING the temporary industrial paralysis that spread through a Middle Western town recently when something went wrong at the power plant and the electric plant shut down, Starling W. Childs, vice-president of Bonbright & Company, speaking before a gathering of bankers at the William Penn Hotel, Pittsburgh, recently, likened the electric light and power industry to the human heart. When the power house stops beating, he said, life dies out of the town; thus the claim of the industry to be a basic one is indispensable. Mr. Childs deprecated the use of the generic term "public utilities" when only electric light and power companies are meant as apt to cause confusion in the minds of hearers. The problems of different classes of utilities vary greatly, and electric companies are free from labor and other troubles with which public utilities of other kinds are beset.

"Aside from the physical importance of the industry," Mr. Childs continued, "we should realize fully the financial importance of its securities. At a meeting of presidents of insurance companies recently it was stated that there are more than a million investors in light and power securities. There is more than $11,750,000,000 invested in public utilities, or $65 for each of the 27,000,000 depositors in the United States. This business is not only basic from a physical standpoint, but also from a financial standpoint, and since it is a basic industry it is essential that it be a healthy business."

Mr. Childs expressed the opinion that advocacy of the operation of utilities by the government would not be heard again for a generation.

New Source of Revenue for Water-Power Company

THE Susquehanna River, flowing as it does through the anthracite coal regions of Pennsylvania, carries down stream quantities of more or less finely divided coal which in the past it has been the custom to dredge with small equipments at various points along the river below the coal fields.

The shortages in the supply of bituminous coal which occurred during recent years have promoted the development of methods of using this anthracite river coal under boilers for steam generation, and this new demand, coupled with an increased demand for anthracite coal for domestic purposes, has led to a greater activity in the recovery of such coal from the riverbed. The great reservoir formed by the Pennsylvania Water & Power Company's dam, it is stated in the company's annual report for 1920, is apparently acting as an efficient settling basin for the depositing of this waterborne coal and its separation from the lighter silt which is carried off further down the stream. Though no accurate survey is as yet possible, it would appear that there are, perhaps, millions of tons of such coal deposited in this reservoir and the company has made arrangements with a dredging concern looking toward the commercial recovery of river coal. The officials of the company feel it desirable that the operations necessary for the recovery of this coal be conducted slowly and in a conservative fashion until such time as the recovery has been demonstrated to be commercially important, and when that time comes it plans to arrange for the recovery upon a scale commensurate with the amounts of river coal brought down and deposited. It is expected that for a few years this recovery will probably remain in the experimental stage.

Electric Service Big Factor in Income of North American Subsidiaries

SEVENTY-ONE per cent of the net 1920 income of the subsidiary companies of the North American Company came from electric service and from heating, as compared with only 13 per cent from electric railways and 16 per cent from gas and coal operations. This significant fact appears in the annual report of the North American Company and its subsidiaries, just issued by Harrison Williams, chairman of the executive committee. The total net earnings less the usual deductions for interest and dividends were $5,396,288, as against $4,580,701 in 1919. The earnings of all of the subsidiaries increased owing to a larger volume of business and increased rates, and though the business depression caused a falling off at the close of the year, a gradual improvement is now looked for.

A striking feature of the balance sheet is the investment of $119,504,435 in property and plant, or about three dollars per dollar of gross earnings. Property and plant investment increased $12,376,041, while capital liabilities increased only $9,895,540, indicating that about $2,500,000 of construction expenditures were financed out of earnings and reserves. In addition to substantially increasing the reserves for depreciation, the subsidiaries expended $4,941,331 for maintenance and renewals. Net working capital amounted to $6,916,896, an increase of nearly $1,000,000 during the year. Accumulated reserves and surplus total $27,708,533, an amount in excess of 90 per cent of the entire outstanding stock of the North American Company.

Kilowatt-Hour Output for 1920 Placed at Nearly Forty-four Billion

FIGURES of electrical generation by public utilities for the month of December have just been issued by the United States Geological Survey. They show a total of 3,750,909,000 kw.-hr. as compared with 3,697,390,000 kw.-hr. for November. Hydro-electric generation was 45,493,000 kw.-hr. ahead of November, the December figure being 1,430,327,000 kw.-hr. Unlike the central-station statistics published monthly by the ELECTRICAL WORLD, the figures of the Geological Survey include electric railways.

Average daily production of electricity in kilowatt-hours by public utility plants for the year 1920, as reported by the Geological Survey, was as follows: January, 124,700,000; February, 119,800,000; March, 120,700,000; April, 119,100,000; May, 115,600,000; June, 118,800,000; July, 116,800,000; August, 119,700,000; September, 120,800,000; October, 120,700,000; November, 123,200,000, and December, 121,000,000. The total output for the year was 43,900,000,000 kw.-hr., an increase of approximately 13 per cent over 1919.

The output for November, 1920, involved the consumption of more than 3,200,000 tons of coal, more than 949,000 barrels of fuel oil and more than 1,837,000,000 cu.ft. of gas.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

A Novel Suggestion on Commission Practice.—A suggestion has been made before the legislative committee appointed to investigate the procedure of the California Railroad Commission that a state "defender" should be appointed, either connected with the Attorney-General's office or maintained separately, whose duty it should be to appear before the commission in rate matters and cross-examine witnesses offered by the utilities in the presentation of the figures on which they base their applications for rate increases.

Power Supply in Japan.—Official figures issued by the Department of Communications of Japan put the number of central stations in the island at 715, the electric railways at 42 and the companies operating both central stations and railways at 53, making a total of 810 electrical enterprises, or an increase of 57 over last year. The total capital of central stations is put at 763,000,000 yen, of electric railways at 56,000,000 yen, and of central stations and railways which are combined at 453,000,000 yen—a total of 1,272,000,000 yen, indicating an increase over last year of 177,000,000 yen.

A Queensland Water Power.—One of the many projected water-power developments in Australia has just been made the subject of a report by a government engineer. The site of this potential undertaking is on the upper Danson River, in Queensland. The engineer reports that very expensive storage reservoirs are a requisite to hydro-electric development in this territory, as the fall in the river is small and in dry seasons would be of little service. He thinks, however, that there are few better sites in Australia for a combined irrigation and hydro-electric scheme and estimates that the necessary dam and plant would cost £160,000.

Kansas City Electrical Show.—Kansas City, Mo., will hold its first electrical show during the week of April 18 to April 23 in the Convention Hall of that city, which will permit a booth space of approximately 14,000 sq.ft. Fifty per cent of this space had already been sold on Feb. 23, and a highly successful exhibition is expected. Two associations—the Missouri Association of Public Utilities and the Kansas Public Service Association—will hold their annual conventions in Kansas City in the week mentioned, affording exhibitors an unusually good opportunity of reaching the utilities branch of the industry in these two states.

Water-Power Generation Four Times Steam Generation in South Carolina.—A report of the Commissioner of Agriculture, Commerce and Industries in South Carolina shows a 120 per cent increase in electricity generated by water power in the last decade as contrasted with an increase of 33 per cent in electricity generated by steam. The commissioner's figures are: 1910—steam-electric, 17,325 hp., and hydro-electric, 41,958 hp.; 1920—steam-electric, 23,040 hp., and hydro-electric, 93,697 hp. There are still 29,197 hp. generated by water and 61,740 hp. by steam without the aid of electricity, but these figures are under those of ten years ago.

Electrification Plans in Spain Reach New Stage.—A comprehensive project for electrical development in Spain has, according to a dispatch under date of March 6, just been presented to King Alfonso, who has given to it his approval. The plan, drafted, it is said, by the leading electrical engineers of Spain, contemplates the construction of enormous electric stations along the principal rivers and railroad lines, extending more than 1,200 miles. The cost is estimated at 200,000,000 pesetas (about $40,000,000 at the old rate of exchange). The intention is to utilize the water power in the rivers and at the same time to use the poorer quality of coal which abounds in many districts. In addition to furnishing power for the railroads, the project contemplates distribution of power for agricultural and industrial purposes.

Hydro-Electric Survey of India.—An official report on the water-power resources of India recently published under government authority contains summaries of data gathered in 1919-1920 from which it appears that Burma contains more power possibilities than any other province, including four sites on the Pan Laung River where from 13,000 hp. to 39,000 hp. might be developed and an estimated minimum production of 10,000 hp. from falls on the Zawgyi River. Reference is made to about forty rivers and sites in the Bombay Presidency, though in some of these areas irrigation has a prior claim on the water sources. Potential horsepowers in Bombay run between 200,000 and 300,000, and the majority of the sources could, the report says, be used without difficulty. Large possibilities are also reported from Madras, the Punjab and other provinces.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Schenectady Section, A. I. E. E.—"The European Economic and Industrial Situation" will be the subject of an address by D. B. Rushmore before this section at its meeting next Friday, March 18.

A. I. E. E. Meeting.—At the three hundred and sixty-eighth meeting of the Institute, held in New York last night (March 11), the subject of discussion was "Developments in Conversion Apparatus for Edison Systems."

New England Commercial Meeting March 18.—The New England Division of the National Electric Light Association will hold a commercial conference March 18 at the American House, Boston, with morning and afternoon discussions of topics of special interest to business men.

March Committee Meetings of Ohio Electric Light Association.—The station-operating committee of the Ohio Electric Light Association is scheduled to meet at Cincinnati on March 16. Henry B. Dates of Cleveland is chairman of this committee. The new-business co-operations committee meeting is to be at Dayton on March 15; chairmen, M. H. Lytle of Piqua and M. W. Arthur of Akron.

Electric Club of Chicago.—W. D'A. Ryan, director of the illuminating engineering laboratory of the General Electric Company, gave a talk on "Ancient and Modern Lighting" before a large gathering of members and guests of the Electric Club of Chicago on March 1. Mr. Ryan, with the aid of slides, showed ancient and modern methods of lighting. His slides showing the wonderful lighting at the Panama Exposition aroused the enthusiasm of his audience. At this week's meeting, on March 8, Charles Munroe, vice-president People's Gas & Coke Company, addressed the club on "Utility Securities from the Owner's Standpoint."

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers — Cleveland Section, March 14; Birmingham Section, March 19; Pittsburgh Section, March 19; Chicago Section, March 22; Philadelphia Section, April 4.

American Institute of Electrical Engineers —Providence Section, March 15; Schenectady Section, March 18.

Associated Manufacturers of Electrical Supplies—New York, March 15. (For program see issue of Feb. 26, page 501.)

Illinois State Electric Association—Chicago, March 15-17.

Wisconsin Electrical Association—Milwaukee, March 23 and 24. (For program see issue of Feb. 19, page 448.)

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section) — New York, March 25.

A. I. E. E. and A. I. and S. E. E.—Joint session, Pittsburgh, April 16.

Missouri Association of Public Utilities—Kansas City, April 21-23.

American Electrochemical Society—Atlantic City, April 21-23.

American Physical Society — Washington, April 23.

United States Chamber of Commerce — Atlantic City, April 27-29.

American Society of Civil Engineers — Houston, Tex., April 27.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Electric Service in the Philippines.—The Philippine Islands Public Utility Commission has forbidden the Tayabas Light & Power Company to charge an arbitrary amount against a customer in a case where the electric meter was found not to be registering accurately, or to discontinue service for non-payment where there exists an honest dispute over the amount due.

Street Lighting and Commercial Lighting Compared. — Overruling a charge of discrimination made by the city of Hermann, Mo., against the Hermann Electric Light Company because the rate charged the city for lighting the streets was higher than the commercial lighting rate, the Missouri Public Service Commission declared that the additional expense incurred by an electric utility in maintaining street lamps justified the increased charge.

Extensions of Service Into Rural Territory.—The Indiana Public Service Commission while ordering the Indiana & Michigan Electric Company to make certain demanded extensions into rural territory observed: "The commission is not unmindful of the difficulties incurred by public utilities in securing funds for extensions, or of the problems presented by extensions of a city electric utility into rural territory, and does not desire to involve respondent in a precedent which will require it to make future extensions in rural territory against its policy."

Combined Minimum and Service Charge.—In the case of a complaint against the Eastern Pennsylvania Light, Heat & Power Company on account of a service charge being included in its schedules in addition to a minimum charge the Pennsylvania Public Service Commission held that the application of the combined charge was inequitable. "The service charge in its widest scope," the commission said, "embraces the consumer's costs and a capacity charge. The minimum charge includes both and a charge for energy. The minimum charge based upon the connected horsepower includes the three factors and, in addition, recognizes, in a measure at least, the extraordinary requirements of the individual consumer, usually covered by a so-called demand charge. It is apparent, therefore, that the respondent by including in one schedule all these charges—namely, service charge, minimum charge and minimum charge based upon demand—is repeating the several items which constitute these charges."

Company Can Collect Legitimate Charge Accidentally Omitted from Statement of Account.—The failure of a utility, through oversight, to bill a surcharge which, in accordance with the order of the California Railroad Commission, was a proper part of its rates for electricity does not, that commission has asserted, absolve any customer from the payment of such surcharge.

Apportioning Valuation of Heating and Electrical Utility.—In a valuation for rate making the Illinois Public Utilities Company apportioned the boiler house, boilers and the greater part of equipment jointly used by the electrical and steam-heating departments of a public utility between these departments upon the basis of their respective maximum steam demands expressed in boiler-horsepower, and land used for coal storage was apportioned in the same ratio as the fuel stored there was divided.

Proper Proportion of Bonds to Stock.—The issuance of bonds under any form of mortgage of more than ten times the face value of the stock of a utility company has been declared against the public interest by the New Jersey Board of Public Utility Commissioners, which also held that the issuance of thirty-year mortgage bonds at 8 per cent interest for the purpose of paying existing indebtedness and providing for new construction would under present conditions create an unnecessary burden upon the consumers of a utility company. Short-term bonds, convertible into long-term obligations when the price of capital becomes less, were favored by the board of commissioners.

The Income Tax as It Affects the Rate of Return.—In declaring 9 per cent to be a reasonable rate of return to the Mutual Telephone Company of Hawaii, the Public Utilities Commission of that territory made this observation on the federal and territorial income taxes: "It has been vigorously contended that in determining the proper allowance for expenses of operation no allowance should be made for income taxes, on the ground that they are properly assessable to the individual and that the legal requirement of the payment of such taxes by the corporation is merely a collection of such taxes at the source. This view, we are aware, has been taken by certain other commissions. As we see it, the fallacy of this view is that it results in nothing more than indirectly reducing the net return determined upon as a reasonable return to the utility. In other words, if income taxes are disallowed as expenses of operation, the net result is that instead of being allowed the 9 per cent which we have determined upon as a reasonable return in this particular case, the return allowed to this utility would be 9 per cent less the amount of the income taxes." The commission therefore included income taxes as proper expenses of plant operation.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Rates Must Have Fair Trial Before Being Declared Confiscatory.—The city of Galveston, Tex., has won in an action brought against it by the Brush Electric Company for a permanent injunction to prevent the abolition of a 10 per cent surcharge on bills to consumers, the United States District Court having reversed a decision favoring the company that had been made by a master in chancery. The federal court rules that the rates prescribed by the city of Galveston have not been proved confiscatory and should have a fair trial to determine whether they will give a reasonable return.

Provision of Insurance Policy Barring Electrical Plant Employees Void When Occupation of Insured Was Clear to Company.—In Hungerford vs. Mutual Life Insurance Company of New York the insurance company sought to bar recovery of the amount covered by a policy because the insured was killed while engaged as stationary engineer in an electric power house notwithstanding that a clause in the policy specifically barred him from "handling electric wires or dynamos." The Supreme Court of Iowa found that inasmuch as the deceased had truthfully stated his occupation and it was common knowledge that men so employed must handle electric wires and dynamos the clause in the policy was void and the insured's heirs could recover. (180 N. W. 849.)*

Responsibility for Unprotected Transmission Wires Cannot Be Shifted from Power Company to Industrial Customer.—In a suit because of the death of a boy from contact with uninsulated high-tension wires entering a factory, damages were assessed equally against the North Carolina Electric Power Company and the French Broad Manufacturing Company. Subsequently suit was brought by the former against the latter to recover the share paid by it, on the ground that the accident was entirely the fault of the industrial company, because by constructing a fill alongside the transformer house it had made it possible for the boy to climb to the roof and reach the wires, which otherwise he could not easily have done. The Supreme Court of North Carolina reversed the verdict found for the plaintiff in the lower court, declaring that the duty of a power company properly to guard its dangerous wires is a primary duty which cannot be shifted to a consumer. (105 S. E. 394.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

H. A. Brody has been appointed manager of the Lindsay district of the Southern California Edison Company. Owing to the greatly increased business of the company and to provide the proper facilities for taking care of its consumers in that territory a new district was created recently, with headquarters at Lindsay, in the San Joaquin Valley. Mr. Brody has had

H. A. BRODY

ten years' experience in the public utility field, of which the last seven have been with the Southern California Edison Company organization. He was born in 1888 in Missouri and went to California in 1910, entering the employ of the Pacific Gas & Electric Company, with which he remained until he joined the sales force of the Southern California Edison Company at Santa Barbara. He was later transferred to the general office, commercial department, and in 1918 was appointed district manager at Lancaster. This position he held up to the first of this year, when he received his transfer to the new Lindsay district.

A. G. Moser, manager of the Ohio Power Company, Bucyrus, Ohio, has been appointed assistant manager of the Canton division of the company. Mr. Moser became associated with the Ohio Power Company in December, 1913.

E. Curtis has been appointed engineer of the power station of the Fort Smith (Ark.) Light & Traction Company. Mr. Curtis succeeds L. J. Noble, who has been made general manager.

Major G. Heustis has been appointed manager of the Vermont Hydro-Electric Corporation, Rutland, Vt., which is controlled by W. S. Barstow & Company, Inc.

C. S. Kennedy, formerly manager of the Southern Iowa Power Company, Chariton, Iowa, has been appointed manager of the Ottertail Power Company, Fergus Falls, Minn., to succeed the late C. B. Kidder. Mr. Kennedy is a graduate electrical engineer of the Ann Arbor University.

Victor Greiff, who joined the American Bosch Magneto Corporation of Springfield, Mass., a year ago, for the purpose of installing and putting into operation a research laboratory for the study and development of electrical automotive equipment, has completed the work and returned to his home in New York City. As a result of Mr. Greiff's efforts the company now has probably the most complete department for ignition research in the country.

C. O. Miniger, vice-president of the Willys Corporation and general manager of the "Auto-Lite" division of that corporation at Toledo, Ohio, has been appointed president and general manager of the U. S. Light & Heat Corporation, Niagara Falls, N. Y., manufacturer of storage batteries, car-lighting equipment and electric arc welders, to succeed J. Allan Smith. Mr. Miniger will continue to be in charge of the "Auto-Lite" division of the Willys Corporation at Toledo. He is well known to the automobile industry. He was one of the original incorpora-

C. O. MINIGER

tors and organizers of the old Electric Auto-Lite Company, and when John N. Willys acquired control of that company Mr. Miniger was placed in charge of its affairs.

Robert M. Stanton, formerly test engineer for the Eastern Shore Gas & Electric Company, Salisbury, Md., has been transferred to the Citizen's Light & Power Company, Oil City, Pa., to assume the position of superintendent of electric operation, succeeding C. C. Christ.

H. W. Williams has been appointed special representative to the general superintendent of motive power of the Chicago, Milwaukee & St. Paul Railroad, with headquarters at Chicago. He was formerly assistant engineer in the electrical department, with headquarters at Seattle.

Herbert Knopf, who was recently promoted to the newly created position of electrical superintendent of the North Bay division of the Pacific Gas & Electric Company, has been engaged

HERBERT KNOPF

in various phases of the electrical industry since graduation from the University of California in 1907. Mr. Knopf was born in San Francisco in 1885. Immediately following graduation he was employed four years in electric train-lighting work by the Southern Pacific Railroad Company, after which, in 1911, he was employed by the Pacific Gas & Electric Company in the Oakland department of electric distribution. Following this he was transferred to San Mateo as assistant superintendent of electric distribution, and lately, as a result of a reorganization, he was made division electrical superintendent.

N. J. Garrison, manager of the El Reno division of the Oklahoma Gas & Electric Company, has been elected president of the El Reno Chamber of Commerce for a third term.

B. H. Clingerman, who has been a member of the engineering staff of the B. F. Goodrich Company at Akron, Ohio, for a number of years, has recently been appointed consulting engineer for the company. Mr. Clingerman was formerly associated with H. M. Byllesby & Company and was general manager of the Mountain States Power Company at Tacoma, Wash.

Frank R. Devlin, a member of the California Railroad Commission, has been elected president of that body by his fellow commissioners in succession to Edwin O. Edgerton. President Devlin was appointed to the commission by Governor Hiram Johnson, his term beginning Jan. 1, 1915. He succeeded John M. Eshleman upon the latter's election as lieutenant-governor. Previous to his appointment as commissioner Mr. Devlin had served the

F. R. DEVLIN

county of Solano as district attorney and as superior judge. Mr. Devlin has devoted much time to the study of power problems and has been responsible for many opinions of the commission on special contracts. During his six years of service he has presided over some of the most important cases in the history of American rate regulation. He has tended to specialization in power and hydro-electric matters, and his decisions in such matters as the Pacific Gas & Electric rate and finance cases laid down the lines upon which the future power development of California will proceed. Equality of payment among purchasers of service has been one of his outstanding economic policies. In 1918, with Commissioner Edgerton, he sat in the Pacific Gas & Electric surcharge case, out of which the decision developed that corporations must abrogate contracts giving special rates to certain consumers. Many of these contracts were of long standing. Mr. Devlin took the position that to favor one consumer is merely to penalize all the rest and that contracts of this sort were of the same illegal character as rebating.

Robert P. Sanborn has been appointed manager of the traction department of the Edison Storage Battery Company with headquarters at the factory and main office, Orange, N. J. Mr. Sanborn is well known to the industry through a connection of several years with the power and mining department of the Erie (Pa.) works of the General Electric Company.

S. N. Clarkson, associate Western editor of the ELECTRICAL WORLD, has resigned to enter business for himself as a consulting engineer and in a specialty sales field which will not conflict with his consulting practice. His office will be in the Star Building, St. Louis. Mr. Clarkson has had a broad experience in the industrial, manufacturing and central-station branches of the electrical industry and has a wide acquaintance both in this country and abroad. He attended the Sydney (Australia) Technical College and for about eighteen months after coming to this country confined himself to practical electrical and mechanical work in the Middle West. In the summer of 1906 he entered the East Pittsburgh shops of the Westinghouse Electric & Manufacturing Company as production clerk. Within a few months he was made assistant foreman and two months later obtained a transfer to the power division of the engineering department. Upon the formation of the company's general engineering division he was appointed to it. He continued in this work until he resigned in 1910 to become industrial engineer for the Union Electric Light & Power Company of St. Louis. The foundation was then laid for the marked growth of that utility's industrial power business which followed, and Mr. Clarkson was advanced to the position of assistant sales manager and sales engineer. When the Milwaukee Electric Railway & Light Company, another subsidiary of the North American Company, planned to build a new power plant in 1917 Mr. Clarkson was transferred to Milwaukee to build up a load for the proposed new generating station. However, the war made it necessary to postpone the building of the new power

S. N. CLARKSON

plant, and two years later Mr. Clarkson accepted an offer to become associate Western editor of the ELECTRICAL WORLD and *Electrical Merchandising*. He is a member of the American Institute of Electrical Engineers and he is also past-chairman of the St. Louis Section.

W. A. Darrow, for the last fifteen years Philadelphia district sales manager of the Elliott Company, Jeannette, Pa., manufacturer of power accesories, has been appointed special representative with headquarters in Philadelphia.

Charles H. True has become vice-president of the Locomotive Superheater Company, manufacturer of superheaters and boilers, in charge of production, with offices at East Chicago, Ind. He became associated with

C. H. TRUE

the Locomotive Superheater Company in 1912 as works manager. Previous to this he was mechanical engineer with the Railways Materials Company at Chicago and was engaged in the design of metallurgical furnaces.

Arthur Purdon has been appointed general sales agent for the Utah territory of the Ideal Electric & Manufacturing Company, Mansfield, Ohio, with offices at 615 Newhouse Building, Salt Lake City.

Obituary

Cecil P. Poole, for a number of years mechanical engineer for the city of Atlanta, Ga., recently died at his home in that city. Mr. Poole moved to Atlanta, May 1, 1912, to engage in engineering work in partnership with Lamar Lyndon, New York City. Later he became identified with the engineering department of the city of Atlanta in connection with the enforcement of the smoke ordinance, and has since been in charge of work of the department of inspection, which included the analysis of illumination gas, of which Mr. Poole had made a special study. Mr. Poole was author of several well-known works on mechanical engineering. His early life was devoted to editorial work, which included editorship of the *American Electrician*, associate aditorship on the staff of the ELECTRICAL WORLD and co-editorship of *Power* for several years.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Trend Toward Development of Low-Head Water Powers

WITH the volume of orders for waterwheels and generators placed last year it is interesting to note the large number of small units—from 625 kva. and below—that were sold. In the past small water-power sites have been neglected, it seems, because the larger and more spectacular developments attracted most of the attention. The development of these small projects is now being looked upon more favorably than ever before. This is particularly true among industrial concerns which have available low-head water powers.

The high fuel and transportation costs and the attention that is being given to water-power developments in general, it is felt, will have a great effect on turning public interest on the many little falls that could be developed for lighting and power purposes in small towns and factories. Machine developments are rapidly tending toward this end. From a financial point of view it is much easier at this time to promote several of these small developments than one of the large ones.

The hydro-electric outlook in general for the coming year seems to be favorable. Although licenses for many large undertakings have been applied for through the Federal Power Commission it is doubtful at this time that many of them, if their applications are approved, can get their finances in shape to go on with the ordering of apparatus this year.

Expect Good Sales of Pole-Line Switching Equipment

FOR the most part buying of farm-light and power pole-line switching equipment throughout the country to date has been curtailed by money tightness, a survey of the situation shows. Good prospects for business are reported by virtually every section of the country, however, and in fact increased sales are already noted in certain of the Mississippi border states. Deliveries are everywhere reported good. Prices of this class of equipment, except for a 10 per cent reduction by one manufacturer in January, remain unchanged. At least one producer is guaranteeing prices until May, but in many quarters lower prices are expected even before that time.

In the Northwest sales to date have been very light and consequently stocks are ample. It is generally expected that demand will pick up there during the next two months. California, it is reported, has presented comparatively little market for this class of material, but large manufacturers are said to be contemplating establishing sales offices in that state with a view to pushing sales.

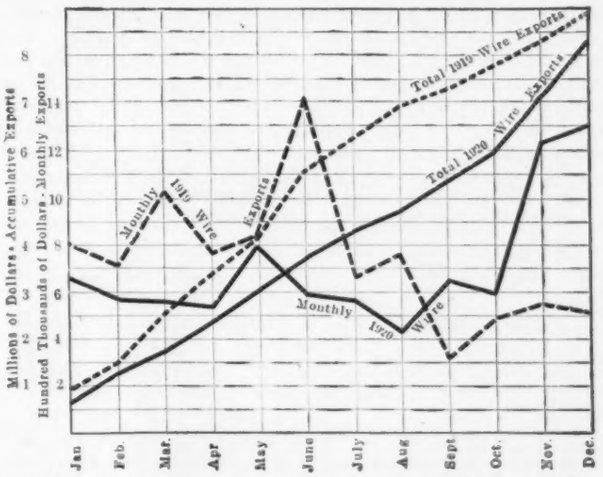
Chicago territory finds business dull. Inquiries have been frequent for equipment of farmer and municipal power distribution lines, however, but only in a few cases can the required financial arrangements be made. Hence no actual orders are being placed. St. Louis reports about a 25 per cent increase in buying over a month ago, with immediate shipments made from local stocks. The South, too, notes an increased movement, but the gain in the latter district is not so marked as it might be because of the farmers' inability to move their cotton.

Central stations in New England are pretty well supplied with material for short extensions and demand there is light. Jobbers' stocks, however, are not especially complete. The Atlantic States as a whole do not at any time present so fertile a field for sales as some other sections of the country, and just now money tightness has curtailed central-station buying. Sales are expected to increase, and customers entering the market will receive better deliveries than at any time since the war.

Wire Exports for 1920 More than Eight Million

WHEN the exports of insulated wire and cable from the United States for the year 1920 are totaled up they come to a value of $8,410,242. This value, however, is nearly $400,000 below the total for the year 1919, which came to $8,792,309.

Taken by the month a small peak of exports was noticeable in May of 1920, but it remained for November to show a radical increase of more than 100 per cent above the month of October, which was an average month up to this time. In the year previous, however, the month of June showed the heaviest increase, although this was well under 100 per cent. Thereafter the exports fell off, and they finished the year at a little over one-third of June's peak. Those of the last four months of 1920 showed a definite trend upward.



MONTHLY AND TOTAL WIRE EXPORTS FOR 1919 AND 1920

1920 AND 1919 INSULATED WIRE AND CABLE EXPORTS FROM UNITED STATES

Country	Value of 1920 Exports	Value of 1919 Exports	Country	Value of 1920 Exports	Value of 1919 Exports
Brazil	$1,266,802	$981,757	Peru	$164,930	$143,861
Cuba	948,387	549,960	Chile	136,094	300,425
Norway	588,274	1,671,412	Sweden	125,400	138,649
Mexico	585,885	339,891	Italy	124,109	40,401
China	562,483	310,592	Dutch East Indies	111,833	292,207
Argentina	451,210	691,355	France	101,711	111,764
England	450,084	257,719	63 miscellaneous countries under $100,000	1,368,652	1,724,240
Philippine Islands	431,321	291,113			
Netherlands	298,490	473,082			
Canada	271,351	197,719			
Panama	237,619	84,140	Total wire and cable exports	$8,410,242	$8,792,309
British India	185,607	192,022			

Brazil took the most insulated wire and cable from the States, $1,266,802, with Cuba a good second at $948,387. Norway, Mexico and China came along together, then

Argentina, England and the Philippine Islands. The remainder were under $300,000 each. There were sixty-three countries taking less than $100,000 each, which made a total of $1,368,652, but their average was only about $22,000. The previous year Norway took the most cable, with Brazil second, Argentina third and Cuba fourth. The Bureau of Foreign and Domestic Commerce compiled the original figures.

January Exports of $15,332,955 Set New High Mark

WITH the month of January, 1921, returning a value of electrical exports amounting to $15,332,955, a new high mark in monthly exports has been set. The 1920 average was $8,550,000 per month. Exports for the whole year of 1910 amounted to only about $14,750,000, a figure below that of the past January alone. The following year, 1911, came up to about $18,750,000, while 1914 showed only $20,000,000. So in the last eleven years the exports have increased twelve times.

It is interesting to note the high rate at which electrical exports have been increasing since last September, especially in view of the decreases shown in the values of exports of all commodities over the last few months.

Exports of insulated wire and cable in January were nearly double those of any previous month, and the figure for motors is well above that of any other month. Miscellaneous exports showed just under the high figure set last December. Transformers, telegraph apparatus, magnetos, spark plugs, etc., carbon-filament lamps, arc lapms, generators, carbons and batteries also were less in January than in some months of 1920. The values of fans, heating and cooking apparatus, metal-filament lamps, meters and measuring instruments, switches and accessories, and telephones were the highest ever recorded. Particular attention is called to the value of fans exported and of metal-filament lamps, figures on which have increased very much.

The Bureau of Foreign and Domestic Commerce has compiled the figures in the attached table:

	January, 1920	January, 1921
Batteries	$374,730	$655,712
Carbons	139,640	70,823
Dynamos and generators	413,293	629,461
Fans	19,587	358,444
Heating and cooking apparatus	103,819	291,546
Insulated wire and cable	661,842	2,447,654
Interior wiring supplies	168,889	422,015
Arc lamps	90	1,430
Carbon-filament lamps	7,133	9,075
Metal-filament lamps	211,697	620,434
Magnetos, spark plugs, etc	261,542	303,900
Meters and measuring instruments	188,123	398,878
Motors	735,236	2,064,424
Rheostats and controllers	18,558	161,253
Switches and accessories	294,036	797,246
Telegraph apparatus	183,404	99,673
Telephones	230,186	659,373
Transformers	350,364	925,372
All others	1,968,152	4,416,242
Total electrical machinery	$6,350,321	$15,332,955

Spring Buying of Poles Is Light

PRODUCERS of Western red and Northern white cedar poles report that the market remains quiet. Spring buying has not yet been in evidence to any extent, though central stations are taking more interest, it is true. Their needs as yet have not advanced beyond the estimating stage, however, while electric railways have given no intention at all of buying. Despite this rather dilatory action of consumers in covering their needs for spring construction work producers are confident that the year as a whole will show good sales. Expectation of price decreases, it is said in some quarters, is one factor in delaying buying as present quotations of poles represent their peak price.

Production of poles this present winter has not been so large as in other seasons. For one thing, there has been a comparatively light snowfall in the regions where dependence is placed upon snow for hauling; and in the second place sizable stocks, light demand and the possibility of a price decrease are said to have operated against a heavy cut of poles.

Good stocks are held at distribution points at present so that shipments are made from stock. An Eastern consumer can therefore count on obtaining poles in from two to three weeks from the date of his order. Representative producers' prices for Western red cedar poles are as follows: 30-ft., 7-in. top, f.o.b. Chicago, $10.90, New York, $12.20; 35-ft., 8-in. top, Chicago, $16.25, New York, $18.30; 40-ft., 8-in. top, Chicago, $19.80, New York, $22.40. Northern white cedar prices are as follows: 30-ft., 7-in. top, f.o.b. Chicago, $11.60, New York, $12.50; 35-ft., 8-in. top, Chicago, $19.05, New York, $20.75; 40-ft., 8-in. top, Chicago, $23.95, New York, $26.15.

High-Tension Porcelain Insulator Prices Lowered

SINCE the middle of February four of the large manufacturers of high-tension porcelain insulators have reduced prices on their product approximately 10 per cent. Not all insulators are included in the drop, however, nor has every manufacturer fallen in line with this reduction as yet. The lower price applies to all suspension units and to all multi-part pin-type insulators. Single-piece pin-type units and strain insulators are not included in the price revision. The first manufacturer to announce a price reduction made the drop effective Feb. 15. Cuts by other producers followed at intervals of from four to six days until the last decrease to be announced thus far took effect on March 1. Other manufacturers are expected to take similar action before long.

Present buying in this field throughout the country, on the whole, is light. Deliveries as a consequence are improving, though but slowly. Stocks of the finished product apparently do not exist anywhere, and nearly all the manufacturers still have such a large volume of back orders hanging over from the previous period of strong demand that shipments will very probably continue to rule long for some time to come. In general, manufacturers are quoting deliveries of high-voltage pin-type insulators on an average of four to five months. Suspension units, on the whole, are in a little better shape as regards delivery. There are, of course, variations both considerably above and below this average with some manufacturers.

The Metal Market Situation

NO IMPROVEMENT is seen in the copper market. Prices are once more fractionally lower, but price cuts, instead of stimulating demand, seem actually to have had the opposite effect. Small producers have this week accepted orders at 12.25 cents delivered for prompt and March shipment; 12.37½ cents for April, 12.62½ cents for May and 12.75 cents for June shipment. Some of the large producers refuse to enter the market at these prices, however. Copper production, as indicated by the February reports of several operating companies, is being cut materially. Offerings in the outside market are small with slightly lower prices there.

NEW YORK METAL MARKET PRICE

	March 1, 1921	March 8, 1921
Copper		
London, standard spot	£ 68 5 0	£ 65 10 0
	Cents per Pound	Cents per Pound
Prime Lake	12.75	12.50
Electrolytic	12.50—12.62½	12.25
Casting	12.00	12.00
Wire base	15.25	15.00
Lead, trust price	4.00	4.00
Antimony	5.20	5.20
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	11.00	11.00
Zinc, spot	5.10	5.30
Tin	30.25	27.50
Aluminum, 98 to 99 per cent.	28.00	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.50-10.75	10.25-10.50
Brass, heavy	6.00- 6.50	6.00- 6.50
Brass, light	4.00- 4.25	4.00- 4.25
Lead, heavy	3.25- 3.50	3.25- 3.50
Zinc, old scrap	3.00- 3.12½	2.87- 3.00

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS seems to be merely holding its own in the jobbing field. In the manufacturing field propositions are appearing over the horizon which were not there at the turn of the year. Inquiries of a price-seeking nature are keeping engineering offices and proposition departments very busy, but actual orders are slow to come in. Money is no easier to collect and no let-up in pressing for payment can be afforded at this time.

Jobbers' stocks are down pretty low and are being kept there as they feel that any renewed demand can be filled promptly from manufacturers' stocks. This may be the result on a larger demand of slight duration, but a protracted demand would soon clean out even producers' stocks.

NEW YORK

Conditions in the electrical market continue to vary. Here and there a jobber reports a slight increase in general demand, while others see no improvement. On the whole, it seems, it must be admitted that present business is quiet not only in staple wiring lines but also on large and small appliances too.

Jobbers are now in a better position to weather a protracted siege of depression, however. Stocks have been reduced until some houses say they cannot possibly get them any lower. Ordering in virtually every line of goods is being carried out on a cautious basis of immediate needs. Collections are pushed strenuously, and though some complaint is heard as to tightness of money the collection situation is not bad.

Competition continues to be strong, and the willingness to cut prices to gain an order remains. Contractors seem to be figuring on considerable work, but actual jobs in sight are lacking. Retailers report that it is hard to get the public to buy. Prices in the past week have not changed.

Conduit.—The average market on black conduit in 2,500-ft. lots this week ranges from $70 to $71.50 per 1,000 ft. for ½-in. and $135 to $137 for 1-in. A very few jobbers continue to hold as high as $80 on ½-in. and $155 on 1-in. black. Demand continues slow with adequate stocks.

Tape.—In 100-lb. quantities standard grades of friction tape are sold for from 45 to 52 cents per pound and rubber from 40 to 51 cents. Stocks are not large and demand is slow.

Flexible Armored Conductor.—Here and there sales are reported to have increased, but general demand remains light. Several jobbers are carrying stocks of between 25,000 ft. and 50,000 ft. From $60 to $66 per 1,000 ft. is asked for No. 14, two-wire, double-strip.

Rubber-Covered Wire.—On orders for 10,000 ft. No. 14 is held at from $7.75 to $8.90 per 1,000 ft. Sales continue very small, but most stocks are at a comparatively low level too.

Vacuum Cleaners.—A few jobbers report fairly good sales and state that demand has picked up. The majority, however, are finding a quiet market with little or no increase in orders. On the whole jobbers are well stocked for present needs, and the almost unanimous report is that spring buying will be done very cautiously. Prices are steady.

Washing Machines.—Very few machines are being carried in stock as the call is light. There is some talk of expected price reductions.

Knife Switches.—Jobbers are about evenly divided in reporting upon sales and the number of switches they carry. Several report either a good or fairly strong demand, while about an equal number say that sales are slow. Stocks, too, vary from small to large. A representative single-throw, two-pole, 30-amp. fused switch sells at $1.06 each, list, in small lots, with 10 per cent discount for an order of $100 value.

Lamp Cord.—One thousand feet of No. 18 cotton, twisted, ranges in price from $16.75 to $20, and No. 18 parallel from $18.75 to $26. Demand is small and, with few exceptions, so is stock.

Distribution Transformers.—Demand has picked up recently and is expected to improve further. One large manufacturer has accumulated a good stock in this territory and can ship any size up to 100 kva. from stock. Another producer still has back orders on hand, so that shipments on sizes under 50 kva. in this instance average sixteen to twenty weeks. Over that size a few units are in stock. Prices are steady since the 10 per cent drop a month ago.

CHICAGO

A marked increase in building activity is noted in Chicago and surrounding cities. The reported cessation of the practice of canceling orders is giving manufacturing interests added confidence and is causing them not only gradually to increase working forces but also to open for reconsideration plans for extensions and improvements which were shelved last fall.

Through recessions that have been made in material prices and improved labor efficiency contractors are able to bid from 15 to 20 per cent less on jobs than could be done last fall. Several hundred cottages and bungalows have been got under way in the past month, and many apartment buildings are being put under contract.

Actual trade has not yet felt the effect of these improved conditions. It will be a matter of weeks before the current dullness is greatly altered. Certain price-cutting operations in household appliance lines have damaged the sale of price-maintained lines. This condition is necessarily of temporary character as prices are felt to be reasonable on this class of material.

Bare Copper Wire.—Quotation on No. 8 bare of $16.50 per 100 lb. in car lots is unchanged, but no merchandise is moving at that figure. This commodity is felt to be the best "buy" in the market today, and each transaction is the result of price negotiation.

Insulated Wire.—As with bare copper, quotations on insulated are unchanged but are merely the basis on which trading begins. The price of $7.85 per 100 lb. on No. 14 rubber-covered is purely nominal, as is also 20 cents per pound for No. 6 triple-braid weatherproof, which is held for quotation purposes on a 19-cent base. Much business is being done.

Conduit.—Quotations are unchanged, $64 per 1,000 ft. being the current price on ½-in. black conduit in 5,000-lb. lots.

Flexible Armored Conductor.—Trade is very quiet, buyers apparently expecting reductions. Improved building conditions should quicken demand for this material before many weeks have passed. In 5,000-ft. lots No. 14, two wire, is quoted $62 per 1,000 ft.

Insulators.—High prices of the past few months still hold, but a decided tendency is noted to shade on special propositions such as high-voltage suspension types. The feeling is general that prices are too high and virtually no sales are being made. Smaller types are getting in better supply.

Washing Machines.—A reduction of overstocks is being accomplished by persistent salesmanship, and it is felt that slowness in the trade has passed the worst point. Manufacturers' operations in this territory average about 35 per cent of capacity. Some price cutting has been engaged in in isolated instances, and this has served to delay the arrival of a feeling of price confidence in the mind of the general public.

BOSTON

Business is marking time this week, and considerable variation is found between different localities in New England. In New Haven jobbing circles a quickening tendency is reported, with inquiries from firearms and silk-manufacturing concerns which have kept out of the market for a long time. The building trades strike is holding down trade at Boston and adding to the non-employment total, but in the leather and textile industries considerable improvement is apparent. Extremely active sales efforts are being made in the field by electrical representatives, and in the domestic appliance market these hard strokes of work are being rewarded. Heavy sales of appliances which can be marketed at low price on account of their being of earlier design are reported from Providence. Collections are carefully followed, and jobbers are not buying to any extent yet. It is said on good authority that if a sudden spurt in business should occur, serious shortages in many of the smaller electrical commodities would be threatened on account of the low production resulting from temporary curtailments in manufacturing plants and the failure of jobbers to buy for stock.

Pole-Line Hardware.—Orders are a bit slack at present, but inquiries are numerous from central stations and municipal plants. Before April a substantial increase in business is expected. Prices are about 10 per cent lower than a month ago and stocks are prepared for brisk trade.

Insulators.—Foreign shipments are absorbing so much of the current output that deliveries are slow and unsatisfactory from the domestic viewpoint. High-voltage construction abroad is keeping American manufacturers very busy, and only moderately good deliveries are being obtained on small quantities of ordinary line service supplies.

Wire.—Rubber-covered No. 14 wire sold at $8 per 1,000 ft. in Boston Monday on a 5,000-ft. basis. Weatherproof was steady at 26½ cents per pound in 100-lb. to 200-lb. lots, and bare copper wire was selling around 16.5 cents. The building impasse is holding down sales.

Non-Metallic Flexible Conduit.—Prices are a little uneven, ranging around $22 and $25 on $\frac{7}{32}$-in. and $\frac{5}{16}$-in. sizes per 1,000 ft., in 5,000-ft. lots, with sales running perhaps 75 cents above and 75 cents below these bases under close competition. Stocks are plentiful and demand easy.

Flexible Armored Conductor.—Plentiful supply and moderate demand have brought prices to about $60 per 1,000 ft., in 5,000-ft. lots, for No. 14 double-strip. Reduced production and uncertain demand have created a rather unstable market.

Lamps.—Despite the falling off in trade usual at this time of year distributers report an excellent business. In some cases the sales being handled exceed pre-war outputs very substantially, and one representative distributer declared Monday that business is virtually normal for this time of year. Stocks are very complete, two assemblies in New England exceeding 2,500,000 units the first of the week. Prices hold steady with the exception of a change in the discount on miniatures effective March 1 on ten-unit standard packages. This was formerly 40 per cent, and it is now 33⅓ per cent, with the requirement of purchasing a single kind or else a stated assortment of display cabinet units.

Distribution Transformers.—Stocks permit factory shipments on receipt of orders for most sizes. New England factories are running full time, and business is better than might be expected under present conditions. Raw material is in good supply, but there is no great excess on hand. Foreign business is slack. Prices are steady since the recent change.

ATLANTA

Building permits for Atlanta for the month of January numbered 189, valued at $587,000, while those for February numbered 232, valued at $554,000. The number and value of the permits, while considerably below that of last year, are sufficient to sustain a fair volume of business activities. Since there is still a shortage of housing facilities, builders express the opinion that building in cities and industrial centers must show an increase in the early spring and summer months. There are signs of activity in municipal construction lines, several of the larger cities having bond issues under consideration. Columbus, Ga., has just passed a large issue, while Atlanta voted on a bond issue of $8,850,000 on March 8. The break in the price of cotton to 10 cents is serving to check what apparently was a reawakening of business activities, but the general opinion is that, despite the further reduction in the price of the staple, conditions will take on a more favorable aspect just as soon as spring weather is here in earnest.

The Atlanta, Birmingham & Atlantic Railroad has been placed in the hands of a receiver by a federal judge, who ordered a sharp reduction in the wages of unskilled labor, and undoubtedly the wages of skilled labor in the employ of this road will follow suit. A strike has been called.

Poles.—Outside of a flurry of two weeks ago, the pole business is reported as stagnant at this time, even in the face of a number of inquiries regarding line extensions. Business is bound to pick up later as improvements are inevitable. Good stocks are on hand and shipments satisfactory.

Ranges.—While there has been little activity in this specialty for some time past, jobbers report a fair volume of sales at the present time. Good stocks are reported and shipments are coming through promptly.

Porcelain.—The completion of a large number of jobs, in Atlanta especially, has had a tendency to maintain the trade in porcelain material, and business is about as good as could be expected. Virtually no change in price is reported other than an uneven condition of heavy stocks.

Wire.—Both weatherproof and rubber-covered wire are moving well, and the attractive prices quoted on rubber-covered have particularly stimulated this line. Local stocks are in good condition in all sizes up to No. 3/0.

Schedule Material.—Conditions reported in this line a few weeks ago still prevail, all jobbers in this section reporting heavy stocks and practically no sales. Prices are steady.

Sewing Machines.—The demand for sewing machines is considerably below that of the same period last year, and jobbers report heavy stocks and little movement. Dealers have reported increasing activity but not sufficient to be reflected in the jobbers' trade as yet.

Vacuum Cleaners.—Jobbers are well stocked and, backed up by prompt shipments from factory, are in a position to handle dealers' trade on short notice. These are depending on concentrated stocks rather than placing orders. Every one, however, is looking forward to a brisk business beginning the middle of March, following national advertising campaigns.

ST. LOUIS

While there are unmistakable signs of business improvement, what increase there is in the trade is not favoring all alike, and as a result there are certain concerns that are somewhat discouraged over the present outlook and others that are perhaps too optimistic. Industry as a whole is not recovering from the general depression as was anticipated, but a number of industrials are resuming operation on a reduced basis. Others are making plans for starting up soon. Utilities are planning extensions to reach new business, and inquiries for prices on line materials for heavy construction are coming in. Almost no changes in prices have occurred during the past week. Stocks in general are complete and in some items, particularly porcelain, are considered too heavy.

Distribution Transformers.—Stocks are about complete in all sizes of distribution transformers for the first time in several years. The demand is slow but is gradually improving, particularly in the Central West and Southwest. One local manufacturer reports the transformer demand as 35 per cent greater than the month before, but explains that sales in the larger power sizes are largely responsible for this increase. Another reports a general increase in all transformer sales. The future is considered good.

Appliances.—Most appliances are moving slowly though

dealers are making heavy cuts to reduce stocks. Unexpected demand for washing machines and vacuum cleaners is developing. Sales in these items are being encouraged by demonstration displays in the surrounding territory.

Insulators.—This is about the only item on which stock cannot be maintained, and sixty-day deliveries are being quoted.

Poles and Cross-Arms.—Demand is light, though inquiries for prices in large lots are persistently coming in and considerable construction work this spring is anticipated. Deliveries can be made from stock. Cross-arm prices are lower than December prices by about 30 per cent. Pole prices are unchanged.

Schedule Material.—Stocks are still topheavy and are not moving satisfactorily, although price concessions have been made and nearly all jobbers are selling below replacement costs. No further reductions in selling prices are anticipated.

Wire.—No material change for the week is noted. Demand is fairly good and stocks are full in both weatherproof and rubber-covered. No. 14 is being quoted at $8.10 per 1,000 ft., in 5,000-ft. lots.

SAN FRANCISCO

A study of the building permits issued for the month of February, 1921, compares very favorably with those issued for February, 1920. In the face of complaints over the paucity of jobs it is seen that, generally speaking, 1921 shows an advance over 1920. The exact figures for February, 1921, are: San Francisco, $3,126,581; Oakland, $966,203; Los Angeles, $3,131,670; San Diego, $909,775; Fresno, $189,650. The exact figures for February, 1920, are: San Francisco, $2,330,395; Oakland, $921,502; Los Angeles, $3,286,415; San Diego, $138,977; Fresno, $594,200. The reverses in the case of San Diego and Fresno are startling but not typical of actual conditions in those cities.

An exceedingly strong advertising association has just been formed to promulgate the advantages of northern California, which includes San Francisco, the bay region and the Sacramento valley. It is now proposed not only to attract tourists and capital to northern California but also to make practical efforts to care for them when they arrive.

Transformers.—California offers a very fertile field for transformers because of the long transmission lines with distributing networks that are now being rushed to completion or actually ready for service. Deliveries on large orders placed last year are coming through in good shape. Present business is good and no difficulty is being experienced in getting equipment through.

Farm Plants.—Sales on farm-lighting outfits have dropped considerably for a variety of reasons. The 1920 crops in a number of sections are still unmarketed because of the refusual of packers to pay the prices asked by various fruit and nut associations. Other crops were sold at considerably less than the growers' expectations. This left little spare money for new purchases and a general spirit of retaliation which has manifested itself in a refusal to buy anything until prices are materially reduced. New distributing systems by which the power companies will take care of hitherto isolated farms are being installed. Local stocks are very good and one or two new companies have made their appearance. The sale of 32-volt devices has been very disappointing, being still far less than it should be even in the case of plants just sold, to say nothing of the immense field awaiting agents who will vigorously canvass those who already have plants.

SEATTLE—PORTLAND

From present indications and according to authorities on conditions the peak of depression in the Puget Sound country specifically and the Northwest generally has been successfully passed. Banks, business, agricultural and manufacturing interests are optimistic, and the reopening of industry, including mills, logging camps and mines, coincident with the return of spring, justifies the optimism. The Seattle Board of Public Works has just awarded contract for furnishing hydro-electric machinery and equipment for the Gorge Creek unit of the Skagit River power project to the Westinghouse company for $1,164,804.

Portland manufacturers report business simply marking time waiting for bottom to be reached in wages and material costs. It is freely predicted, however, that this period of waiting will be passed within a comparatively short time. Jobbers report business improving a little. There has been another reduction in wire and in pole-line material, but porcelain registered a recent advance. Generally speaking, electrical contractors in Portland territory report business very quiet and that only small jobs are being handled. Plans for all large construction projects are being held up temporarily pending the outcome of a conference relative to voluntary wage reductions. The credit and collection situation remains unchanged.

Distributing Transformers.—Stocks on hand, carried mainly by Central Stations, are very light and in keeping with demand which, owing to slackness in building construction of consequence, is at a minimum. Present prospects for spring and early summer demand are more or less dubious, depending almost entirely on the action taken by prospective builders of business buildings. Replacements are not hard to obtain.

Farm-Lighting Plants.—Movement of this merchandise throughout the Northwest generally is practically at a standstill. Farmers have neither money nor credit to buy, owing to decreases in prices of wheat, fruit, potatoes and other products. Many farmers are still holding out for a return of high prices. Jobbers are heavily stocked with plants, many of them overstocked. No shipments are coming in from the East because they are not needed. Prices show no change, but it is anticipated that a drop will be made during the summer.

SALT LAKE CITY—DENVER

The curtailment of lumbering and mining in the Intermountain region has created considerable non-employment during the winter just drawing to a close; resumption of operations, however, is expected with the coming of spring. The need of employees on farms will also absorb thousands of the unemployed and relieve the situation greatly. The best statistics available indicate that business in the wholesale field is equal to if not better than business in the corresponding period of 1920. Liquidation of member banks in the twelfth Federal Reserve district has proceeded rapidly in the last four or five weeks, a reduction of $20,000,000, or 12.6 per cent, having occurred. Business failures are far more common than they were a year ago, but the situation is not critical.

Certain sections of Idaho and Montana have been particularly hard hit. Many electrical firms, both wholesale and retail, are in a critical condition right now. The demoralized condition of the agricultural market is held responsible for the bad state of affairs now existing. In spite of difficulties, however, business men are optimistic and are doing everything in their power to stem the tide. Co-operative leagues are being resorted to in several sections.

Vacuum Cleaners.—The rate at which dealers are stocking indicates their confidence in a flourishing business in vacuum cleaners. Easy-payment plans and complete demonstrations are the two things chiefly relied on to stimulate sales. More attention is being paid to cleaner attachments than has been apparent heretofore.

Washers.—Intensive advertising campaigns are the outstanding feature of the trade in washing machines. One concern obtained fifty signed contracts on the first day of its drive. As little as one dollar down is being accepted on contracts that will run for twenty or more months. Stocks are plentiful. No further price reductions have been reported.

Lamp Standards.—Renewed interest is taken in street lighting installations after a long period of small activity due to municipal retrenchment. One jobbing house recently secured a contract calling for 112 metal standards, each to be equipped with three 2,000-cp. lamps.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Stanley Insulating Company Changes Hands

The Stanley Insulating Company, Great Barrington, Mass., has been acquired by new interests, including officials of Landers, Frary & Clark, New Britain, Conn., manufacturers of electrical cooking and heating equipment. Operations, it is understood, will be conducted as heretofore and no change is contemplated in the personnel of the company at the present time.

Reorganization of Electric Equipment Company

The Electric Equipment Company, Spokane, Wash., with stores at Colfax, Lewiston and Walla Walla, has been reorganized, A. M. Cash, of Lewiston, becoming president and manager. Vice-president K. G. Harlan has resigned. A plan to separate the management of the stores was voted down. The headquarters will remain at Walla Walla.

Locomotive Superheater Changes to Superheater Company

On March 1 the name of the Locomotive Superheater Company, 30 Church Street, New York City, was changed to the Superheater Company. A realization of the necessity for greater conservation of fuel in other fields in addition to that represented by the steam locomotive has resulted in the expansion of the organization to serve in all fields where steam is used for power.

The original company had recently acquired the patents and business of the Locomotive Feed Water Heater Company in order to conduct the further application of the apparatus for preheating feed water through its regular engineering, inspection and service organizations, to which has been added the operating organization of the Locomotive Feed Water Heater Company.

Piedmont Electric's Plan to Help Dealers' Dishwasher Sales

In an endeavor to help its dealers introduce and sell dishwashing machines, the Piedmont Electric Company, electrical supply jobber of Asheville, N. C., is asking its dealers to send in lists of their best customers so that it can introduce the machine to them. The Piedmont company states that it will arouse the customer's interest first with a convincing mail campaign; then, following that up, will send its salesmen out with the dealer's representatives to assist them in closing sales. A machine on the dealer's floor for demonstration is advocated as a clinching evidence of practicability.

Bacharach Instrument Moves to Larger Quarters

The Bacharach Industrial Instrument Company, Pittsburgh, has moved to 7,000-7,006 Bennett Street, Homewood Station. This new building is a two-story brick structure of 18,000 sq.ft. floor space, the additional space acquired by this purchase giving considerably increased facilities in production and service. The company has added a new line of monometers and engine indicators, the monometers being of an entirely new design.

Charles Eisler Buys National Machine & Tool

Charles Eisler, consulting engineer, 159 Clifton Avenue, Newark, N. J., has purchased the assets of the National Machine & Tool Company, Newark. The firm's name has been changed to the Charles Eisler Engineering Company, and it will manufacture gear testing machines as well as incandescent lamp machinery in addition to its regular consulting engineering and machine designing. The factory and offices are at 15 Kirk Place, Newark.

Dudlo Acquires Land for Future Expansion

The Dudlo Manufacturing Company, Fort Wayne, Ind., has just purchased five acres of ground near its present buildings, although there are no immediate plans for erecting buildings on this space. The company during the last year put up two new buildings at its present plant and also established branches at Peru and New Haven, Ind., but it has sufficient space at hand to take care of the present low demand for magnet wire, etc.

Los Angeles Dealer Turns to Specialty Distributer

The Woodill & Hulse Electric Company, Los Angeles, Cal., announces the closing of its retail store, established in 1891. The company will confine its efforts in the future to the distribution of specialty electrical appliances at wholesale exclusively.

Coonley Predicts Big Business After Liquidation

Howard Coonley, president of the Walworth Manufacturing Company, Boston, in an address on March 4 before the Associated Industries of Massachusetts on "The General Business Outlook," forecast several years of intense business activity following the completion of the present liquidation period. He pointed out that until liquidation is completed in the ferrous-metals field and in the labor market business cannot go ahead at full speed. By the end of the first half of 1921, Mr. Coonley said, he expected this process to be ended. The absorptive power of the domestic market, including the tremendous building program and the volume of buying by the railroads essential to their proper development, insures an era of industrial greatness once the present transition period is concluded.

Western Electric's 1920 Sales Were $206,000,000

Sales in 1921 Expected to Show Larger Volume of Company's Products and Smaller Volume on Products of Other Manufacturers

From figures given in the annual report for 1920 of the American Telephone & Telegraph Company, the sales billed by the Western Electric Company during the year 1920 amounted to $206,000,000. Of this, $114,000,000 were to the Bell companies and $92,000,000, largely electrical jobbing business, were to other customers. This is an increase over the previous year of 62 per cent to the Bell companies and 41 per cent to other customers, or a total increase of 52.6 per cent.

Unfilled orders on hand at the end of the year aggregated $83,000,000, as compared with $47,000,000 on Dec. 31, 1919. The company's estimates for 1921 as compared with 1920 indicate a larger volume of business in its own manufactures and a smaller volume in its sales of the manufactures of others. Important additions were made to the Hawthorne plant, chiefly for the purpose of providing facilities to produce machine-switching telephone equipment in large quantities.

Maker of Heavy Penstocks Adds Mill Capacity

The M. W. Kellogg Company has in process of construction a three-million dollar plant adjacent to its present plant in Jersey City, N. J. When it is put into operation in the early fall it will increase the company's capacity for producing welded steel pipe about six times. It will be especially equipped to handle very heavy material for penstock work—material of high head and large diameter and thickness. On the forty-two acres of ground the new

buildings will occupy about 250,000 sq.ft., including space under cranes.

An interesting feature of two recent orders which this company has taken for penstocks for the Pacific Gas & Electric Company and the Southern California Edison Company is the heavy tonnage in lap-welded steel pipe involved. For the former company's Pit River No. 1 installation two 1,026-ft. lines, 8-ft. diameter at lower end and 9-ft. at upper end, $\frac{1}{16}$-in. to $\frac{1}{4}$-in. thickness, 875 tons of steel will be used. The operating head is 425 ft. For the latter company's No. 8 Big Creek development there is a single 2,225-ft. line, 6 ft. at lower end and 7 ft. at upper end with $1\frac{1}{4}$-in. to $\frac{3}{8}$-in. thickness. The tonnage required is 650 tons with operation on a 717-ft. head. This is in addition to a certain amount of riveted pipe.

Pole Producers Hold Quarter-Century Meeting

The twenty-fifth annual meeting of the Northern White Cedar Association, held in Minneapolis, Minn., on Feb. 8 and 9, was attended by thirty-two firms representing producers of poles, ties, logs, etc. Regarding the outlook for the present year, genuine work and sales effort are seemingly going to be required to maintain sales. "We are starting 1921 with January, as a whole, the poorest business month in years. February should be better, and along later in April and the first of May we should be acquiring a full head of steam and be going ahead on a real normal basis," president Furlong said.

L. A. Page, Jr., of Page & Hill Company, speaking for the pole advertising committee, said: "Let us suggest that there will be no reward in 1921 for the man or concern who 'quits cold' or 'lays down.' The customers of the members of your association will be somewhat more careful as to prices and more critical regarding quality. Business will be good this year—for the man who thinks and digs for it. The intelligence of your sales effort and extent of your advertising will determine the size of your 1921 crop of sales."

Membership of the association increased from forty-four to forty-nine companies in 1920. Seven new companies were admitted to membership while two others withdrew.

Western Electric Salesmen's New Motor School at Lynn

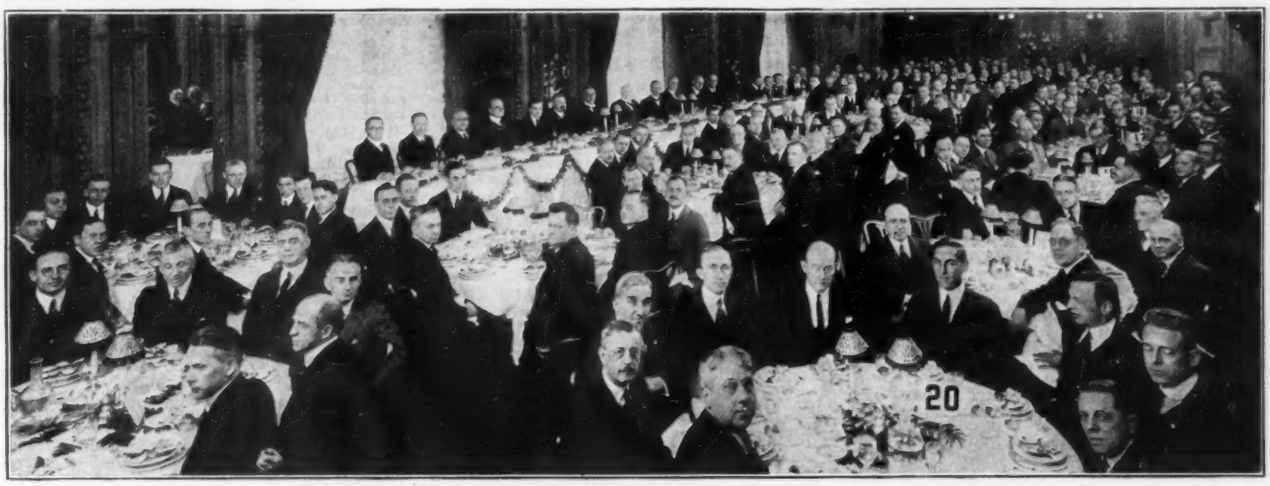
The Western Electric Company in conjunction with the General Electric Company has organized a power apparatus class at the factory at Lynn, Mass., to acquaint the members of its sales force with the manufacturing conditions which prevail in the production of motors, generators and other electrical apparatus. Classes are being conducted each month with an average attendance of fifteen salesmen. J. L. Ray, power apparatus sales manager of the Western Electric Company, is the originator of the new school. The personnel of the first classes were members of his company's sales organizations at New York, New Haven, Boston, Syracuse and Philadelphia.

Increase Production to Decrease Prices

In speaking of prices and wages, *Trumbull Cheer* for February — the house organ for the Trumbull Electric Manufacturing Company, Plainville, Conn., says: "Generally speaking, the lines that have come down the most are those on which the greatest profit has been taken. A general average must be reached, the attaining of which will cut some prices in two and other prices in much less proportion, among which is electrical material, for the very simple reason that profit has been less than normal on the average and a big saving in production cost must be obtained before any material reduction in selling price can be expected. We with all others in the electrical trade will welcome the time when prices can be reduced and a normal profit enjoyed.

"The situation regarding wages is exactly like that surrounding prices. There has been the same inequality in wages as in commodities. The product of a factory must be sold in competition with similar products of other factories, and if the other fellows reduce prices these lower prices must be met or the concern that fails to meet them will soon be out of the running.

"The way to keep wages up when prices fall, or, better, the way to enable prices to fall without reducing wages, is to increase production and stick to a normal profit. The employer cannot increase production all by himself; the workman can and must thoroughly learn that he is the only one who can keep his wages up by turning out more material which can be sold at a profit without the necessity of putting more men on the payroll."



NEW YORK EDISON COMPANY'S FIRST ALL-ELECTRIC VEHICLE SHOW OF JAN. 31 TO FEB. 12 BROUGHT TOGETHER 265 FOR THE LUNCHEON AT THE HOTEL ASTOR

The Conveyors' Corporation of America, 326 West Madison Street, Chicago, formerly the American Steam Conveyor Corporation, announces that the Power Equipment Company, 131 State Street, Boston, has been appointed as New England representative for the sale of its American trolley carrier, monorail equipment for handling coal, ashes, sand, etc. Colwell & McMullin, 79 Milk Street, Boston, are the New England representatives for its American steam ash conveyor.

The Stewart Manufacturing Corporation, 4500 Fullerton Avenue, Chicago, announces the establishment of a permanent Cleveland office, 419 Bangor Building, 942 Prospect Avenue, in charge of E. P. Grismer. The company manufactures die-molded castings and bronze-back bearings.

The Bleadon-Dunn Company, 213 South Peoria Street, Chicago, has appointed the Western Agencies Company, 285 Minna Street, San Francisco, as its Pacific representative. The latter company has branch offices at 125 East Ninth Street, Los Angeles, and 923 Pine Street, Seattle.

The Automotive Electric Service Corporation, 206 Amsterdam Avenue, New

York City, has filed notice of increase in capital stock from $10,000 to $50,000.

Tennant Brothers, Dallas, Tex., successor to the Texas Battery Company, has filed notice of increase in capital stock from $20,000 to $25,000. The company manufactures batteries.

The Stenman Electric Valve Grinder Company, 42 Southbridge Street, Worcester, Mass., contemplates taking additional space in the Stevens Building, which it will equip for the manufacture of a new combination electric drill and valve grinder.

The Shaw Metal Manufacturing Company, Seattle, Wash., has leased a site at Twentieth Avenue and Madison Street, where it will establish a plant for the manufacture of copper and brass tubing, sheets, lighting fixtures, roadlight reflectors, etc. It is expected to have the copper and brass plant in operation within six months. Copper and brass sheet rolling machinery will be installed four months later. Henry A. Shaw, 524 New York Block, is president.

The Mid-State Battery Manufacturing Company, 615 West Grand Street, Oklahoma City, Okla., recently organized, is planning to establish a local plant to manufacture storage batteries and accessories.

The American Insulator Company, New Freedom, Pa., it is reported, is asking for bids for the erection of a local plant on Main Street for the manufacture of electrical insulating products, to cost about $75,000.

The Connecticut Electric Manufacturing Company, Bridgeport, Conn., has filed notice of increase in capital stock from $200,000 to $450,000.

Foreign Trade Notes

EXTENSION OF LIGHTING SYSTEM IN SINGAPORE. — Vice-Consul Donoghue reports that the Legislative Council has approved a loan of $385,000 to the commissioners of the municipality of Singapore for the extension of the electric lighting system to the Tanglin district.

IRRIGATION AND POWER DEVELOPMENT IN BRITISH INDIA.—A very important irrigation development, known as the Sutlej Valley Project, is to be undertaken in the Punjab, an agreement having been reached between the government of India and the native states of Bahawalpur and Bikanir, according to an announcement from the Guaranty Trust Company of New York. The project will irrigate an area of more than 9,000,000 acres and greatly increase the wheat-growing possibilities of India, and will be the means of generating electric power for industrial and domestic purposes to the amount of about 300,000 hp. The work to be undertaken involves an estimated expenditure of fourteen crores rupees (1 crore is equivalent to 10,000,000 rupees, and 1 rupee equals $0.486 at par).

ELECTRICAL MANUFACTURING PLANT AT BILBAO, SPAIN.—The Sociedad Ibérica de Construcciones Eléctricas (S. I. C. E.), according to the London *Electrical Industries*, has been formed by the Thomson-Houston Company of Paris and the General Electric Company of the United States, with the co-operation of the principal local banks and hydro-electric concerns, for the purpose of manufacturing electrical equipment. The company plans to erect a plant in the vicinity of Bilbao.

FOREIGN TRADE CONVENTION.—The eighth national trade convention called by the National Foreign Trade Council will be held at Cleveland on May 4, 5, 6 and 7. The American Manufacturers' Export Association, it is said, will take a prominent part in the convention. The office of the National Foreign Trade Council is at the India House, No. 1 Hanover Square, New York City. O. K. Davis is secretary.

AMERICAN CHAMBER OF COMMERCE IN EGYPT.—According to information received by the Foreign Commerce Department of the Chamber of Commerce of the United States the American Chamber of Commerce of Egypt has been organized, with headquarters at Alexandria, by business men of Alexandria and Cairo. It is intended that the office shall be used as headquarters for American commercial travelers, who will be placed in communication with local firms dealing in their lines. The American Consul at Alexandria was elected honory president of the chamber.

HYDRO-ELECTRIC PLANT IN ICELAND CONTEMPLATED.— A message from Reykjavik to the *Berlingske Tidende*, according to the London *Engineer*, states that the Islandske Ingenicer-Forening has requested the government and the Alting to institute investigations with a view to defining the possibility of establishing an industry in Iceland, using the waterfalls as the motive power. The Forening also requests the government to receive applications for a concession to construct a large hydro-electric station.

ELECTRICAL MACHINERY PROPOSED FOR THE PORT OF SAVONA, ITALY.—The Savona (Italy) Harbor Board is reported to be considering the installation of electrical discharging machinery at the port of Savona at an early date. The erection of four electric bridges for the unloading of coal is also under consideration.

GERMAN INDUSTRIAL COMPANIES CONSOLIDATE. — The Allgemeine Elektrizitats-Gesellschaft of Berlin, it is reported, has merged with the locomotive works of Linke Hofmann of Breslau, whose share capital has been increased from 64,000,000 marks to 120,000,000 marks. The Allemeine Electrizitats-Gesellschaft receives 30,000,000 of the new shares in exchange for shares of the original company.

New Apparatus and Publications

EXPORT PACKING.—C. C. Martin has just written "Export Packing," a guide to the methods employed by successful shippers. It comprises over 700 pages and is published by the Johnson Export Publishing Company, 370 Seventh Avenue, New York City. Considerable attention is given to the packing of electrical material.

HICKIES AND BRACKET HOOKS.—The B. & L. Stamping Company, Inc., 155-9 Jamaica Avenue, Brooklyn, is distributing a leaflet describing the "Belmet" stamped hickies and bracket hooks.

CONTROL.—"Increasing the Press Output" is the title of publication 888 distributed by the Cutler-Hammer Manufacturing Company, Milwaukee, describing the C-H pre-set motor control for platen, cylinder, offset, sheet-feed rotary and small web presses.

CORDS AND FIXTURES.—The Inland Electric Company, 15 North Franklin Street, Chicago, has issued a folder on "Steelite" armored portable extension fixtures.

MOTORS.—Bulletin No. 1 of the S. A. Woods Machine Company, Boston, on its new general-purpose induction motors is being distributed.

METALLIC FLOORING.—The Irving Iron Works Company, Long Island City, N. Y., have issued catalog 3A on their fireproof ventilating flooring.

CELL TESTER.—The Sterling Manufacturing Company, 2845 Prospect Avenue, Cleveland, has issued bulletin No. 10-A, describing the "Sterling" No. 600 high-rate cell tester.

WAFFLE IRON.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has placed on the market a new electric waffle iron.

INDEXES.—The General Electric Company, Schenectady, N. Y., has issued two indexes to its descriptive bulletins, sheets and supply part bulletins dated January, 1921.

STATIC CONDENSERS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 49,714C, superseding bulletin No. 49,714B, covering its static condensers.

HYDROELECTRIC STATIONS.—"Automatic Hydro-Electric Generating Stations" is the title of bulletin No. 40,604, published by the General Electric Company, Schenectady, N. Y., in which two types of control are described.

BUS SUPPORTS.—The Delta-Star Electric Company, 2433-53 Fulton Street, Chicago, has recently developed a new unit-type extra-heavy busbar support.

FIRECLAY PRODUCTS.—The "Refractories Book" is the title of a booklet issued by Laclede-Christy, St. Louis.

AUTO-TRANSFORMER STARTER. — The Cutler-Hammer Manufacturing Company, Milwaukee, has developed a new auto-transformer starter for standard squirrel-cage motors of various capacities ranging from 5 hp. to 100 hp.

INSULATING MATERIALS.—The John C. Dolph Company, Newark, N. J., has issued a catalog describing its insulating varnishes and compounds.

BANK PROTECTION SYSTEM. — Edwards & Company, 140th and Exterior Streets, New York City, manufacturer of electrical signaling apparatus, is distributing a bulletin describing the Edwards "bank hold-up alarm system."

INSULATION.—A new slot insulation, which is a combination of fibrous paper and varnished-cambric put together with an insulating binder, is being placed on the market by the Irvington Varnish & Insulator Company, Irvington, N. J.

FARM-LINE EQUIPMENT.—The Railway & Industrial Engineering Company, Greensburg, Pa., has recently placed on the market a horn-gap switch, triangular choke coil, lightning arrester and horn-gap fuse, all combined as a single unit on one base.

PORTABLE ELECTRIC PLANT. — The Home Electric Lighting Company, East Orange, N. J., is distributing a folder describing its "Homelite" portable electric plant for the home, farm and summer camp.

UNIT PANEL EQUIPMENT.—Bulletin L-110 issued by the Allen-Bradley Company, Milwaukee, describes its type L-120 unit-panel battery-charging boards for electric vehicles.

TIERING-LIFTING TRUCK.—The Automatic Transportation Company, Buffalo, has issued bulletin No. 25, describing its electric tiering-lifting truck.

SCRAPER CONVEYORS. — The Jeffrey Manufacturing Company, Columbus, O., has issued catalog No. 257, in which it describes the "Jeffrey" standardized scraper conveyors.

ELECTRIC FURNACES.—The Pelton & Crane Company, Detroit, is distributing a pamphlet describing the "Pelton" porcelain outfit and the Pelton dental electric furnaces.

POST DRILLS.—The Black & Decker Manufacturing Company, Baltimore, has designed a post drill especially for adapting its portable electric drill for use as a drill press for heavy drilling or precision work.

CRANE CAB.—The Pawling & Harnischfeger Company, Thirty-eighth and National Avenues, Milwaukee, has developed a new crane cab in which all controller and current-carrying parts are inclosed.

COMPRESSORS.—The Chicago Pneumatic Tool Company, 6 East Forty-fourth Street, New York City, has issued bulletin No. 607, covering the Chicago pneumatic oil-engine-driven compressors.

New Companies

THE PROVIDENT PRODUCTS CORPORATION, Wilmington, Del., has been incorporated by Charles B. Bishop, A. M. Fox and R. H. Ochletree. The company is capitalized at $300,000 and proposes to manufacture lighting devices.

THE RADIANT ELECTRIC COMPANY, Binghamton, N. Y., has been incorporated by H. J. Bowen, and G. E. and V. D. Sturdevant. The company is capitalized at $5,000 and proposes to manufacture electrical supplies.

THE METER SERVICE CORPORATION, New York, N. Y., has been incorporated by S. A. Gafvert, F. W. Fouglas, G. E. Scobal, 1790 Broadway. The company is capitalized at $25,000 and proposes to manufacture electrical instruments.

THE ELECTRIC LIGHT & POWER COMPANY, Remington, Va., has been incorporated with a capital stock of $25,000 to take over the plant and property of the Electric Power & Milling Company. A. L. Hord is president of the company and C. W. Hoffman is secretary.

THE COTE BROTHERS MANUFACTURING COMPANY, Chicago, has been incorporated by Thomas F. Cote, Hubert N. Stronck and Elmer H. Greaves, 4670 West End Avenue, with a capital stock of $60,000. The company proposes to manufacture electrical devices, etc.

Record of Electrical Patents

Notes on United States Patents

(Issued Feb. 15, 1921)

1,368,507. ALTERNATING-CURRENT ARC-WELDING SYSTEM; Johannes Kjekstad, Brooklyn, N. Y. App. filed May 27, 1919. Compensating automatically for variations in resistance.

1,368,536. WINDING MACHINE; James C. Anderson, Rutherford, N. J. App. filed Aug. 13, 1919. Coil winder.

1,368,560. OZONE GENERATOR; Edward L. Joseph, Westminster, London, England. App. filed July 19, 1920. Electrode consists of a metallic sheet.

1,368,576. ELECTRIC POWER PLANT; Johannes C. Ruths, Stockholm, Sweden. App. filed Aug. 5, 1916. Reserve steam tank.

1,368,584. CATHODE FOR AUDIONS; Samuel S. Torrisi, Philadelphia, Pa. App. filed July 10, 1918.

1,368,590. ELECTRIC LAMP BASE; Edson B. Wilcox, Meriden, Conn. App. filed June 30, 1919. Means for automatically severing connection in case of short circuit.

1,368,599. TYPEWRITING MACHINE; Harry Bates, New York, N. Y. App. filed Jan. 29, 1919. Automatic carriage return.

1,368,622. AËRIAL SYSTEM EMPLOYED IN WIRELESS TELEGRAPHY AND TELEPHONY; Charles S. Franklin, Buckhurst Hill, England. App. filed Aug. 26, 1920. For directional working.

1,368,635. ELECTRIC STARTING SYSTEM FOR INTERNAL-COMBUSTION ENGINES; Franz Kratz and Gottlob Honold, Stuttgart, Germany. App. filed Aug. 1, 1918.

1,368,657. WIRELESS DIRECTION FINDER; Henry J. Round, Muswell Hill, London, England. App. filed Sept. 13, 1920. Used on board ship.

1,368,659. TESTING APPARATUS; Charles S. Sapp, Jr., and Ray Sapp, Mount Vernon, Ohio. App. filed Feb. 26, 1920. Internal-combustion engine.

1,368,677. SIGNALING DEVICE; Walter S. Woodward, Great Falls, Mont. App. filed Oct. 11, 1919. Set for any time.

1,368,678. RESISTANCE UNIT; William Zabel, Swissvale, Pa. App. filed July 15, 1919. Mounted on small insulating drum.

1,368,686. SPARK INTENSIFIER FOR GASOLINE ENGINES; William G. Bennett, Adrian, Wash. App. filed June 12, 1920. Auxiliary gap.

1,368,694. STARTING RHEOSTAT FOR ELECTRIC MOTORS; Arthur H. Buckley and Reginald A. Buckley, Paddington, New South Wales, Australia. App. filed Sept. 4, 1919. Direct current.

1,368,700. PORTABLE ELECTRIC LAMP; De Witt C. Conkling, New York, N. Y. App. filed June 9, 1917. Without batteries.

1,368,728. STYLUS PICKER; Benjamin F. Hutches, Jr., Allendale, N. J. App. filed Oct. 6, 1919. For phonographs.

1,368,741. ELECTRIC STARTER FOR INTERNAL-COMBUSTION ENGINES; Albert H. Midgley, Acton Vale, England. App. filed July 10, 1915. For motor cars.

1,368,755. SPEED-CONTROL SYSTEM; John H. Roddey, Charlotte, N. C. App. filed May 14, 1919. Prime mover.

1,368,791. BURGLAR ALARM; Kuwakichi Fujita, Hazleton, Pa. App. filed Oct. 10, 1919. Cartridge-firing mechanism.

1,368,798. TRAFFIC REGISTER; Gabriel Henry, Quebec, Canada. App. filed March 9, 1920. For photographing the traffic on a street.

1,368,811. PROTECTIVE SYSTEM FOR ELECTRICAL CONDUCTORS; Karl Kurda, Nuremberg, Germany. App. filed Jan. 14, 1915. Equalizes strength of electric field between conductors carrying high-potential currents.

1,368,817. STORAGE BATTERY; Paul M. Marko, Brooklyn, N. Y. App. filed July 5, 1918. Level of electrolyte easily and quickly ascertained.

1,368,828. TIME-CONTROLLED STARTING AND STOPPING MECHANISM; Jose A. Oca Balda, New York, N. Y. App. filed Aug. 8, 1919.

1,368,850. AUTOMATIC TELEPHONE SYSTEM; Arthur B. Smith, Evanston, Ill. App. filed June 13, 1917. Automatic calling between exchanges.

1,368,916. VIBRATOR; Joseph C. Field, Orange, N. J. App. filed Dec. 29, 1919. High-frequency tone.

1,368,946. ELECTRICAL SYSTEM; Joseph K. Leibing, Newark, N. J. App. filed Nov. 19, 1917. Ignition of gas engines.

1,368,955. APPARATUS FOR ELECTROLYZING SALT SOLUTIONS; Tadao Matsushima, Kanagawken, Japan. App. filed March 18, 1918. By mercury process.

1,368,990. PROCESS OF PRODUCING ARTICLES OF QUARTZ GLASS; John Scharl, New York, N. Y. App. filed Sept. 18, 1918.

(Issued Feb. 22, 1921)

15,047 (reissue). ELECTRICAL HEATING DEVICE; Francis Boardman, New York, N. Y. App. filed July 13, 1916. For melting snow and ice in vicinity of railway switches.

15,048 (reissue). TELEPHONE EXCHANGE; Frank A. Lundquist, Portland, Ore. App. filed April 13, 1915. Automatic.

1,369,003. SEMI-MECHANICAL SWITCHBOARD; William G. Blauvelt, New York, N. Y. App. filed Jan. 29, 1919. Office keyboard arrangement.

1,369,019. SIGNALING SYSTEM; Joseph C. Field, Orange, N. J. App. filed Nov. 26, 1917. Selectively operated signaling system.

1,369,022. CALLING DEVICE; Charles L. Goodrum, New York, N. Y. App. filed Sept. 14, 1917. Automatic telephone.

1,369,025. AUXILIARY SPARK DEVICE FOR IGNITION SYSTEM; Raymond Hawley, Cambridge, Mass. App. filed Nov. 15, 1919. Covered.

1,369,060. DISPLAY APPARATUS; Ralph L. Tedesco, Rockland, Mass. App. filed July 17, 1919. For exhibiting series of announcements.

1,369,066. TYPEWRITING MACHINE; John Waldheim, Elizabeth, N. J. App. filed May 10, 1919. Automatically returns carriage and line spaces.

1,369,094. ELEVATOR; Ernest L. Gale, Sr., Yonkers, N. Y. App. filed Dec. 28, 1916. Automatically levels elevator car with landing.

1,369,128. CAR-LIGHTING SYSTEM; Harry D. Rohman, New York, N. Y. App. filed April 16, 1917. Railway and other vehicles.

1,369,148. ELECTRIC CHANGE-SPEED GEARING; Thorsten von Zweigberck, Lancaster, England. App. filed Dec. 13, 1916. For use on an automobile.

1,369,167. LOCKING MEANS FOR SHELLS; Victor R. Despard, Hinsdale, Ill. App. filed April 6, 1918. Lamp socket.

1,369,168. LOCKING MEANS FOR SHELLS; Victor R. Despard, Hinsdale, Ill. App. filed April 6, 1918. Lamp socket.

1,369,204. PROCESS OF MAKING CHROMOUS CHLORIDE; Maurice C. Taylor, Niagara Falls, N. Y. App. filed Dec. 15, 1919. Electrolytic reduction of chromic chloride.

1,369,218. TELEGRAPHY; William M. Bruce, Jr., Springfield, Ohio. App. filed May 13, 1916. For lines where resistance and capacity have tendency to start signals.

1,369,220. ENGINE-STARTING SYSTEM; William A. Chryst, Dayton, Ohio. App. filed Sept. 30, 1915. For internal-combustion engines.

1,369,271. CLEANING OF METALLIC SURFACES; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed July 3, 1919. Previous to plating.

1,369,281. ELECTROMAGNETIC-WAVE-TRANSMITTING SYTEM; Oscar C. Roos, Brooklyn, N. Y. App. filed Nov. 4, 1918. Continuous oscillations.

1,369,284. AMPLIFYING RELAY; August J. Kloneck, New York, N. Y. App. filed March 8, 1915. For telephone.

1,369,288. AUTOMATIC TELEPHONE EXCHANGE; Frank A. Lundquist, Chicago, Ill. App. filed Aug. 21, 1900. Improved switch operation.

1,369,297. COMMUTATING DYNAMO-ELECTRIC MACHINE; Edward G. Parvin, Roselle, N. J. App. filed April 9, 1920. Simple and effective interpole.

1,369,298. PRODUCTION OF FERROSILICON ALUMINUM; William B. D. Penniman and Roy S. White, Baltimore, Md. App. filed June 9, 1919. Electric furnace.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PATTEN, ME.—The Katahdin Electric Company, recently incorporated, contemplates the erection of a transmission line from Houlton to Patten, connecting up Smyrna Mills, Island Falls and other towns along the route. At Houlton connection will be made with the high-tension line of the Gould Electric Company.

PORTLAND, ME.—The William Underwood Company, 50 Fulton Street, Boston, Mass., will install considerable electrical electrical equipment in its new plant to be built in Portland at a cost of about $150,000.

SPRINGFIELD, VT.—Gilman & Son will install electric motors and considerable electrically operated machinery in their proposed two-story machine shop, 50 ft. x 150 ft.

NORWOOD, MASS.—Bids, it is reported, are being received by E. C. Brown & Company, engineers, 220 Devonshire Street, Boston, for the construction of a power house, 133 ft. x 300 ft., for the Hollister Mills Company, Lenox Avenue, Norwood. The cost is estimated at $200,000.

PROVIDENCE, R. I.—The United Electric Railways Company plans extensions and improvements to its power plant on Manchester Street, including the installation of new equipment. The company also contemplates extensions to its substations and improvements to its lines.

GOSHEN, CONN.—The incorporation of the Goshen Electric Light & Power Company to supply electric light and power service in this village is provided for in the bill introduced in the State Legislature. The company plans to purchase energy from the Connecticut Power Company, Falls Village, whose high-extension line runs through Goshen.

Middle Atlantic States

BUFFALO, N. Y.—Plans are under way by the Lower Niagara River Power & Water Company for the construction of a hydro-electric power plant. Preliminary permit has been granted the company by the Federal Power Commission to utilize 20,000 cu.ft. of water per second from Whirlpool Rapids for operation of the new plant.

GRAHAMSVILLE, N. Y.—The Ulster-Sullivan Electric Light & Power Company, recently incorporated with a capital of $40,000, contemplates the operation of a local electric light and power system with transmission lines to extend to various municipalities in Sullivan and Ulster Counties. S. W. Krum and others are incorporators.

GRANVILLE, N. Y.—The construction of a power plant is planned by the Telescope Cot Bed Company, 535 East Seventy-ninth Street, New York City, in connection with its proposed local factory to cost about $100,000. R. G. Gory, 50 Church Street, New York City, is engineer.

NEW YORK, N. Y.—The Central Catskill Light & Power Company, recently incorporated with a capital of $50,000, plans to operate an electric light and power system in Ulster and Delaware Counties. J. Hollander, 601 West 184th Street, and others are incorporators.

SARANAC LAKE, N. Y.—The erection of a high-tension transmission line in the vicinity of Saranac Lake, Tupper Lake and Lake Placid is under consideration by the St. Lawrence Transmission Company of Potsdam.

SYRACUSE, N. Y.—The Franklin Automobile Company will establish a new power plant for general works service in connection with its new plant addition now under construction. The cost, including machinery, is estimated at $500,000.

MORRIS PLAINS, N. J.—Bids will be received by the Department of Architecture, 142 West State Street, Trenton, until March 22 for the construction of a psychiatric clinic reception building, including electric work, etc., at the State Hospital at Morris Plains. F. H. Bent is state architect.

NEWARK, N. J.—The International Coal Products Company, Irvington, is negotiat-

ing with the Irvington Town Council for permission to reconstruct its power plant and primary oven, recently damaged by fire, at its fuel briquet plant, causing a loss of about $100,000.

NEWARK, N. J.—The Board of Education will install considerable electrical equipment, heating and ventilating apparatus, etc., in several new school buildings.

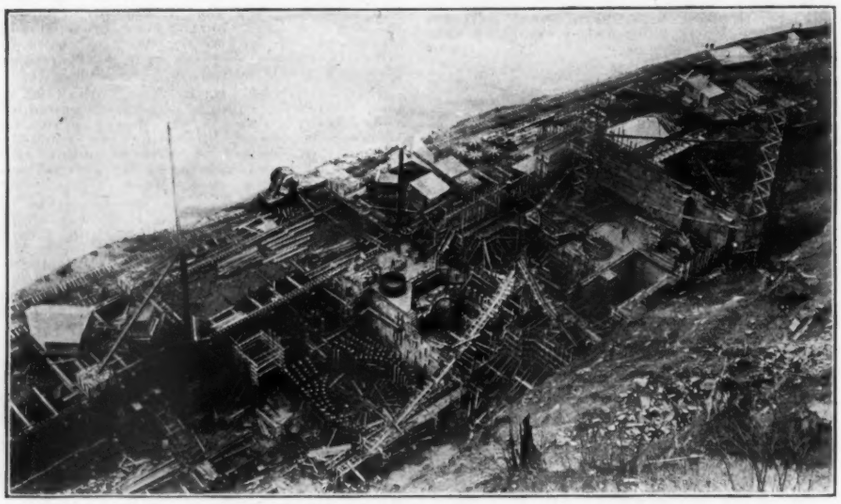
PERTH AMBOY, N. J.—A power plant will be constructed by the Burnrite Coal Briquette Company, 543 New Jersey Railroad Avenue, Newark, in connection with its new plant at Perth Amboy. Conveying and hoisting machinery and other electrically operated equipment will be installed.

LANCASTER, PA.—The Conestoga Traction Company has applied to the Public Service Commission for authority to issue $160,000 in bonds, part of the proceeds to be used for extensions and improvements.

LANSDALE, PA.—The Borough Council has postponed bids for equipment for the municipal electric light plant.

NEW CUMBERLAND, PA.—W. A. Dromgould, 143 West Market Street, York, has obtained preliminary permission from the Federal Power Commission to build a water-power plant at Marsh Run, York County. Present plans provide for a development of 88,000 hp.

PHILADELPHIA, PA.—Bids, it is reported, will soon be received by the Department of City Transit, 1211 Chestnut Street, for the construction of a one-story sub-



BIRD'S-EYE VIEW OF CONSTRUCTION UNDER WAY FOR 500,000-HP. HYDRO-ELECTRIC PLANT BEING BUILT BY THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO AT QUEENSTON

station at Front Street and Fairmont Avenue, in connection with other buildings to be constructed at this location. W. S. Twining is director.

SCRANTON, PA. — Arrangements have been made between the city officials and the Scranton Electric Company for a new street-lighting system under a ten-year contract. Plans include 200 new lamp installations and replacing and relocating the present arcs and incandescents with 400-cp., 250-cp. and 100-cp. lamps, totaling 1,554 lamps. The contract also provides for an initial installation of a boulevard lighting system on sections of Spruce Street, Lackawanna and Wyoming Avenues. W. A. Schunk is city engineer.

YORK, PA.—The transformer station and toolhouse of the Delta Lighting & Power Company, it is reported, has been damaged by fire, causing a loss of about $10,000.

YORK, PA. — Arrangements are being made by the City Council for an issue of $1,000,000 in bonds for municipal improvements, including the enlargement of the sewage disposal plant and the installation of new electrically operated machinery.

WILMINGTON, DEL. — The Bowers Beach Corporation will establish an electric lighting system and install other electrical equipment in connection with the development of Bowers Beach into a pleasure resort. W. H. Durborough is president.

BALTIMORE, MD.—Plans have been approved by the Public Improvement Loan Commission for the installation of a new electrically operated pumping plant at the Black River disposal plant to cost about $11,000.

BALTIMORE, MD.—The Union Memorial Hospital plans to install considerable electrical equipment in the proposed group of buildings to be constructed in the University Parkway district. Plans are under way by the board of directors.

WILLIAMSPORT, MD.—The W. D. Byron Company has plans under way for the construction of a power plant at its local works to cost about $50,000. Quigley Hafer, 155 Garfield Street, Chambersburg, Pa., is architect.

BRISTOL, VA.—The Electric Transmission Company has increased its capital from $500,000 to $1,200,000. L. B. Herrington is president.

COLEMAN, VA.—The Bedford Pulp & Paper Company, 909 East Main Street, Richmond, has plans under way for an addition to its electric power plant, including a complete new unit, in connection with its works at Coleman.

North Central States

WHITEHALL, MICH.—At the spring election to be held soon the proposal to issue bonds to the amount of $33,000 for a new electric light and water plant will be submitted to the voters.

CLEVELAND, OHIO.—The City Council has passed an ordinance authorizing an issue of $300,000 in bonds for improvements to the municipal electric lighting system.

DELAWARE, OHIO.—The Fairfield Paper Box Company, Baltimore, Ohio, will build a one-story power plant in connection with its new paper mill and box factory in Delaware. The total cost is estimated at $160,000. T. D. Griley is manager.

DAWSON SPRINGS, KY.—Bids will be received at the office of the supervising architect, Washington, D. C., until March 28 for the complete construction, excepting mechanical equipment, of a power house for the United States Public Health Service Sanatorium at Dawson Springs. Plans and specifications may be obtained at the above office.

LEXINGTON, KY.—The City Commissioners have been petitioned to install an ornamental lighting system on Short Street.

PADUCAH, KY.—The Paducah Electric Company has plans under way for the construction of an addition to its power plant and remodeling the present building. A turbo-generator, switchboard and considerable other equipment will be installed. The cost of this work is estimated at about $200,000. Other improvements, including line extensions, will be made at a cost of about $50,000. Stone & Webster, 147 Milk Street, Boston, Mass., are engineers.

TERRE HAUTE, IND.—The Terre Haute, Indianapolis & Eastern Traction Company, it is reported, contemplates improvements to its local power plant to cost about $600,000. Plans include the construction of an addition to power plant, installation of additional equipment, extension of service lines and placing wires under ground, etc. E. M. Walker is general manager.

CHICAGO, ILL.—The Floyd Manufacturing Company, 522 South Clinton Street, manufacturer of tools, has awarded contracts for the construction of a two-story plant, 122 ft. x 240 ft. and a power house, 32 ft. x 60 ft., at Diversey and North Harding Avenues. The cost is estimated at about $160,000.

DANVILLE, ILL.—The installation of a boulevard lighting system on Vermilion Street has been approved. E. K. Wolgamot is president of the commission.

EAU CLAIRE, WIS.—At an election to be held April 5 the proposal to purchase the local distribution plant of the Wisconsin-Minnesota Light & Power Company will be submitted to the voters. The cost of the plant is estimated at about $350,000.

MANITOWOC, WIS.—Enlargement of the municipal power plant and extension of the transmission line is contemplated. H. Groth is in charge.

MINNEISKA, MINN. — The Wisconsin-Minnesota Light & Power Company plans to erect an electric service line from Kellogg to Minneiska.

COLBY, KAN.—Bonds to the amount of $60,000 have been voted for improvements to the electric lighting plant. The plans include the installation of two 175-hp. and 200-hp. horizontal return tubular boilers, two 175-hp. and 200-hp. simple non-condensing Corliss-type engines, direct-connected to 2,300-volt, three-phase, 60-cycle generators, with complete boiler room accessories, motor-driven boiler-feed pumps, motor-driven deep-well pump and complete switchboard equipment. C. E. Reid, Manhattan, is engineer.

MINNEAPOLIS, KAN.—At an election to be held April 5 the proposal to issue $60,000 in bonds for the construction of an electric light plant will be submitted to the voters.

WILSEY, KAN.—Bonds to the amount of $18,000 have been authorized for the establishment of an electric lighting system in Wilsey. The plans include the erection of a 6,600-volt transmission line to Council Grove, a distance of 11 miles, and the installation of a distributing and street-lighting system. C. E. Reid, Manhattan, is engineer.

Southern States

MOUNT OLIVE, N. C.—Bonds to the amount of $30,000 have been issued for improvements to the electric lighting system.

LAKE ARTHUR, LA. — Bonds to the amount of $50,000 have been voted for the installation of an electric light plant.

SKIATOOK, OKLA. — Charles Page of Sand Springs contemplates the installation of a lighting system at Skiatook. R. Harris is representative.

ELECTRA, TEX.—The power house of the Gladiolus Oil Company, it is reported, has been damaged by fire, causing a loss of about $10,000. The plant, it is understood, will be rebuilt.

Pacific and Mountain States

MARSHFIELD, ORE.—The construction of an electric light and power plant in Marshfield to cost about $110,000 is under consideration.

OAKDALE, CAL.—The Oakdale Irrigation District Board is considering the question of utilizing the water power of the new Melones dam to generate electricity. H. H. Wadsworth is consulting engineer. H. B. McMath of Riverside is director of board.

SAN FRANCISCO, CAL. — The Great Western Power Company, 14 Sansome Street, has completed plans for the construction and completion of its new hydro-electric plant at Plattsville, Plumas County. The cost is estimated in excess of $1,000,000.

WOODLAND, CAL.—The City Trustees have authorized new bids to be asked for the installation of an electrolier system.

PARAGOULD, ARK.—Bids will be received by the Commissioners of the Paragould Water District No. 3, at the office of W. R. Heagler & Sons, Engineers, Bertig Office Building, Paragould, until April 12 for the construction of a power house and for power plant and pumping equipment in connection with waterworks project. The cost is estimated at $120,000.

Canada

ST. THOMAS, ONT. — Residents of Yarmouth and Southwood are petitioning for the extension of electric service lines from St. Thomas to the two townships.

AMOS, QUE.—The Temiscaminque Company will soon ask for bids for the development of water power on the Megiscane and Bell Rivers.